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MASSIVE BILATERAL PRERETINAL TYPE OF HEMORRHAGE  
ASSOCIATED WITH SUBARACHNOIDAL  
HEMORRHAGE OF BRAIN\*

WITH CASE REPORT AND PATHOLOGIC FINDINGS

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## INTRODUCTION

Both subdural and subarachnoidal hemorrhages of the brain may invade the corresponding cavities of the optic nerve and ordinarily will remain localized in that space, if there is no traumatic rupture of the arachnoid that allows the blood to pass into both spaces. Duke-Elder<sup>1</sup> classifies *subarachnoidal hemorrhage* as: (1) traumatic (the occasional case), due to rupture of meningeal blood vessels usually in a basal fracture, and (2) non-traumatic (the usual case), in which the blood always comes from an intracranial origin; either from (a) aneurysm, usually basal, rupturing into the subarachnoid, (b) spontaneous intracerebral hemorrhage bursting into the subarachnoid, or (c) meningeal hemorrhage in blood dyscrasias.

*We shall concern ourselves chiefly with hemorrhage into the nerve sheath from a bleeding basal aneurysm.* Most of the reported cases are not associated with hypertension or blood-vessel disease; most are precipitated by some temporary increase of blood pressure; most of these aneurysms are in an artery of the first order and most are in the anterior half of the circle of Willis; occasionally the aneurysm may be located in a cortical

branch. Usually the aneurysm is congenital and often it is associated with supernumerary blood vessels or other minor congenital anomalies of the circle. Occasionally the aneurysm is thought to be acquired as a result of infected emboli, atheroma, or syphilis (Duke-Elder<sup>2</sup>).

In 1924 Symonds<sup>3</sup> reported a series of 124 cases of "Spontaneous subarachnoid hemorrhage" (that is "spontaneous," or nontraumatic). In only 14 of these 124 cases were the fundi described; 3 of these patients had subhyaloid hemorrhages and 6 had papilledema. In this masterful 27-page article the author divides the cases into four clinical groups, patients in the first of which die suddenly, as in other apoplexies, and those in the last of which (a hypothetical group) have such gradual hemorrhage as to be almost asymptomatic until the grand attack occurs. The other groups are a coma- and later-meningeal type, and a purely meningeal type.

*Premontory signs and symptoms* are often present over many years, and usually are caused by the leakage of varying amounts of blood. Duke-Elder<sup>4</sup> lists them as: (1) Paroxysmal headaches which are severe, sudden in onset, come on after some exertion, and are often associated

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with tinnitus. (2) Coma, then signs of meningeal irritation with delirium, vomiting, restlessness, severe headaches, neck rigidity, positive Kernig, positive Babinski, and paresis of cranial nerves especially the third and sixth. (3) Ocular signs: The extension of hemorrhage into the optic-nerve sheath produces a fairly characteristic picture of papilledema and hemorrhages, an associated palsy of third and sixth nerves in 70 percent of the cases, and moderate proptosis considered due to the hematoma of the nerve. Almost invariably the ocular signs are bilateral although enough unilateral cases are described to emphasize that this need not be so.

*Papilledema* is the most common finding. Usually it is slight in amount, and only rarely is it entirely absent. It is almost invariably bilateral, and characteristically comes on with great rapidity (Uthoff, 1901, described it within 30 minutes of onset). The papilledema is of particular interest because it is supposed to be due to the same essential cause as the papilledema of brain tumor. Many of the reported cases show marked hematoma of the nerve sheath, and not a few cases are reported in which definite constriction of the central retinal vein within the distended subarachnoid space was demonstrated (Dupuy-Dutemps<sup>5</sup>). This obstruction of the central retinal vein within the subarachnoid space as in other papilledemas is supposed to be due to: (1) the increased pressure within the subarachnoid space, (2) the double angulation of the vein produced by the distention of the subarachnoid space; (3) the actual axial elongation of the intra-arachnoid portion of the vein produced by the stretching of the vein between its attachments to pia and arachnoid. In this connection the observation of Dupuy-Dutemps of hemorrhages within the dural sheath due to tearing the

elongated vein where it seems rigidly attached to the dura, is of interest.

*The retinal hemorrhages.* In the great majority of cases the retinal blood vessels are normal. Usually the hemorrhages are small and located near the disc (Duke-Elder<sup>6</sup>), but in four cases proved with serial sections, MacDonald<sup>7</sup> found two with large subhyaloid hemorrhages some distance from the disc. Hale White<sup>8</sup> reported a case with symmetrical, large, brick-red hemorrhages in each eye, about four times the size of the disc and encroaching a little upon it. MacDonald states that *subhyaloid hemorrhages are not necessarily in close contact with the disc*, and that probably the fact that the large retinal arteries usually cross the large retinal veins near the disc may be the factor which in many cases tends to fix the location of the hemorrhages near the disc. According to MacDonald, also, ruptures of the deeper veins would produce punctate hemorrhages, and rupture of the small veins in the fibro-vascular layers would produce striate hemorrhages. All these types of hemorrhages were found in one of MacDonald's cases. MacDonald concludes that *the internal limiting membrane seems to be a definite structure capable of localizing a venous or capillary hemorrhage outside the vitreous body*, and advances this conception as further proof that these hemorrhages are, in fact, not arterial, since arterial hemorrhage frequently ruptures the internal limiting membrane, allowing the blood to penetrate into vitreous. Occasionally the hemorrhages are subretinal, but some of the old authors called preretinal hemorrhages, "subretinal" (see Hale White's article).

*Source of intraocular hemorrhage.* No continuity between the retinal and nerve-sheath hemorrhage has been demonstrated in any recent cases. Duke-Elder<sup>9</sup> states that Liebrecht concluded there must be

such continuity, and Hale White had reported the actual continuity. However, Doubler and Marlow<sup>10</sup> also claimed in a case of rupture of an *aneurysm of the internal carotid* with subhyaloid hemorrhage that blood had been forced from the subarachnoid space through nerve substance and lamina cribrosa into the retina, and they had serial sections to substantiate this contention. In such a case the pressure within the subarachnoid might be very high. Paton,<sup>11</sup> who pioneered in investigations of the mechanism of papilledema, said that "subhyaloid hemorrhages in subarachnoid brain hemorrhage are the result of direct leakage of blood through the subpial lymph spaces around the lamina cribrosa and through the perivascular lymphatics that surround the central vessels." He believed fully that the subhyaloid hemorrhage directly communicated with the hemorrhage in the subarachnoidal space of the optic nerve. Symonds<sup>12</sup> also concludes that, in his case, blood had been forced through the lamina cribrosa into the subhyaloid space and quotes both Hale White and Doubler and Marlow to show that this may be the source of subhyaloid hemorrhage. In all three of these cases (Doubler and Marlow, Symonds, and White) there was a ruptured aneurysm of the internal carotid artery in which very high pressure might be transmitted to the subarachnoidal space. Because of the question as to the source of hemorrhage, MacDonald investigated his four specimens (in two of which there were large subhyaloid hemorrhages) thoroughly with serial sections and came to the conclusion that blood was not forced from the nerve sheath into the eye. All other reported cases, except those of Doubler and Marlow, Symonds, and White, were conspicuous for the fact that the blood was not forced through the lamina cribrosa.

Riddoch and Goulden<sup>13</sup> state "The

ophthalmoscopic appearances conform very much with our ideas of venous engorgement of the retina which are seen in its *most marked instance in cases of thrombosis of the central retinal vessel*. The obstruction in hemorrhage of the optic nerve sheath is sudden, thus causing appearances similar to those seen in thrombosis of the central retinal vessel although the *results are not so serious as the obstruction is neither so complete nor so prolonged as in thrombosis*."

Riddoch and Goulden<sup>14</sup> also state that post-mortem evidence indicates that whether or not there will be ocular hemorrhage in cases of subarachnoid hemorrhage depends upon (1) the severity of the hemorrhage, (2) situation of the aneurysm, and (3) presence of scar tissue from previous hemorrhages (arachnoidal adhesions in the cisternae basalis and chiasmatis). Thus if scar tissue prevents the hemorrhage from passing down the optic-nerve sheath, there may be no intraocular signs. If only one optic-nerve sheath is "patent" the intraocular signs, if any, will be present only in that eye.

Diagnosis of hemorrhage into the subarachnoidal space of the optic nerve may be made with considerable certainty when there are papilledema, retinal hemorrhages, palsy of third and sixth nerves, and a history of either head trauma or of a sudden seizure with signs of increased intracranial pressure, or with signs of meningeal irritation. The diagnosis is confirmed by lumbar puncture and the finding of bloody spinal fluid (Duke-Elder<sup>15</sup>).

#### CASE REPORT

Mrs. D. B., white, aged 36 years, a patient of Drs. C. J. Vollmar and R. A. Kinsella, entered St. Mary's Hospital on September 6, 1943, at 10:00 a.m. and died September 30, 1943. At 9:00 a.m. while

preparing for church the patient suddenly complained of severe frontal headaches, and had to be led to a sofa, whereupon within less than five minutes she lapsed into a coma with convulsions in which there were periods of rigidity of extremities, jaws, and back. Her face became fiery red and she vomited profusely. She never regained consciousness. Dr. Vollmar was called and sent the patient to the Hospital within the hour.

*Past history.* When the patient was 12 years old she and her sister had St. Vitus's dance, from which they both recovered completely within several months. At the age of 14 years, she wandered about for two days without knowing who she was, then suddenly recovered. She had had frequent severe headaches since childhood. Seven years ago the patient had what was diagnosed as meningitis, with stiff neck and vomiting. No lumbar puncture was done. Since that time she had had many more headaches than before. The headaches were very severe frontal headaches associated with increasingly severe nausea and vomiting. She frequently was awakened with severe headaches. She was diagnosed hypertensive  $2\frac{1}{2}$  years ago, and one year ago was told not to become pregnant again because of hypertension. She had a fall from a horse 20 years ago without known injury. No other injuries were known to her husband. She had had no operations. There was no definite ocular history, and no history of diplopia.

*Family history.* Grandfather died of paralysis. Mother died of diabetes. Father and brother both died of coronary disease. One uncle has had a bad heart since youth.

*Marital history.* One child, nine years of age. Otherwise negative.

*Physical examination* was made one hour after onset of the present illness. The patient was a well-developed and

-nourished woman of 36 years, comatose, face markedly flushed, breathing rapid and shallow. There was moderate tonic convulsive rigidity. Her jaws were clamped tightly on a gag. The eyes were closed, the pupils moderately dilated and fixed to light and accommodation. Ophthalmoscopic examination by the interne was recorded: "The right fundus shows a choked disc. Left fundus cannot be seen." The blood pressure was 200/104, pulse 98 and regular, respiration 40. Examination of chest showed generalized loud moist rales, which obscured the heart sounds. Babinsky reflex was positive on both sides.

#### PROGRESS NOTES

*September 7th.* Patient had purposeful movements of the limbs and occasionally tried to talk. Right Babinsky had decreased and left was negative.

*September 8th.* The patient's blood pressure was running 100-112/60-80, in both arms. She had severe pain in the right side of the neck posteriorly and winced when this area was touched.

*September 9th.* She had been moving hands a great deal scratching furiously and beating both hands against abdomen. Her right arm was more active than her left. Blood pressure was now 202/116. Pulse and temperature were normal.

*September 11th.* Ophthalmoscopic examination recorded by interne: "Numerous hemorrhages are present over the right retinal surface. Left eyeground not visualized." Temperature 102.6°F. respiration 22, pulse 90, blood pressure 182/100.

Spinal tap showed pressure 380 mm. of water. When 7 c.c. of bloody spinal fluid was removed the pressure dropped to 135 mm. of water. General condition remained about the same.

*Examination by one of us (L. C. D.):*  
"The pupils react well to light. The

eyes are turned up and out. Homatropine 1 percent produced dilatation to 8 mm.

"Ophthalmoscopically the entire posterior pole of each eye for a width of about 10 D.D. is covered by a large retinal or preretinal hemorrhage of uniform dark brick-red color through which no fundus details are visible. The hemorrhage seems centered over the area where the disc should be. There is a sudden sharp transition from hemorrhage to the normal retina in the periphery, the edge of the hemorrhage is rather smooth, and the outline is roughly circular as in preretinal hemorrhage. The media are clear. The blood vessels in the visible normal retina are free of arteriosclerosis; the veins are markedly tortuous but only moderately engorged."

*Diagnosis:* "Massive subarachnoidal hemorrhage of the brain extending down along the optic nerve. It is believed that usually such hemorrhage of the eye is due to compression of the central retinal vein within the subarachnoidal space of the nerve. Very frequently the cause is congenital aneurysm of the basal arteries. Occasionally such aneurysms have been attributed to meningitis of which there is a possible history here."

*September 16th.* Lumbar puncture: spinal fluid bloody, pressure 85 mm. of water. One cubic centimeter of fluid withdrawn.

*September 17th.* Ophthalmoscopic examination (L. C. D.), with dilatation ad maximum. "All the gross hemorrhage in each eye has been absorbed. Cannot make out even the location of the discs through a dense grayish haze which seems centered over the disc area to a width of 3 to 4 D.D. The obscured area is much smaller than the hemorrhage first seen on September 11th. The peripheral retina uncovered by the absorbed hemorrhage seems normal."

*September 22d.* Ophthalmoscopic ex-

amination (L. C. D.) showed no change over September 17th. Lumbar puncture showed the intraspinal fluid pressure to be 235 mm. water. When 10 c.c. of bloody spinal fluid were withdrawn, the pressure dropped to 180; then 8 more c.c. were removed, after which pressure dropped to 85.

*September 29th.* Ophthalmoscopic examination (L. C. D.). "No change from September 17th and 22d." Twelve hours later the patient had 6 to 8 convulsions; blood pressure was 240-290/110-160. Pupils were dilated but reacted to light, Babinsky reflexes negative. During intervals between convulsions the patient relaxed completely, pupils constricted and were fixed to light. Convulsions continued and *two hours later*, the patient regurgitated a mouthful of fluid, then immediately aspirated it, became cyanotic and respiration became labored and very irregular. Trendelenburg position, oxygen, artificial respiration, coramine, all were ineffective. Respiration gradually ceased, cyanosis increased, and within a minute after respiration ceased, the heart stopped.

POST MORTEM. September 30th, 8:30 a.m.

GENERAL. Rigor mortis four plus. Hypostasis slight. Body is well developed and well nourished. The heart weighs 360 grams, shows no evidence of infarction or scarring. The valve cusps are delicate and competent. The coronary arteries are straight and patent and show minimal atheromatous change. There is grade I (minimal) atherosclerosis of the aortic lining. Microscopically, there is hypertrophy of myocardial fibers, and there are a few lymphocytes in scattered subendocardial foci. The blood-vessel walls are not thickened and there is no evidence of inflammatory reaction. Hyaline change in the walls of the afferent glomerular arteries of the kidney is evident and there is minimal medial hypertrophy of small

arteries. There is marked congestion of the pulmonary vasculature with apparent thickening of interstitial lung tissue. The remaining general findings are minor and irrelevant. Death is considered to be respiratory, incident to the cerebral pathology.

*Cerebrospinal system:* The brain with membranes exclusive of dura weighs

dissects away with great difficulty. The cisterna cerebellomedullaris is choked with hemorrhage but shows no increase in trabecular consistency. Frank blood is in evidence in a subarachnoid position over the foramina of Luschka. The cisterna superius and the cisterna venae magnae cerebri are similarly engorged. The cisterna pontis shows patches of old

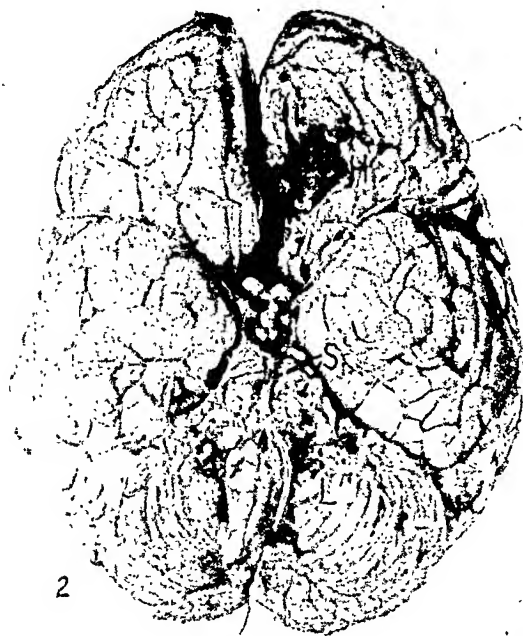
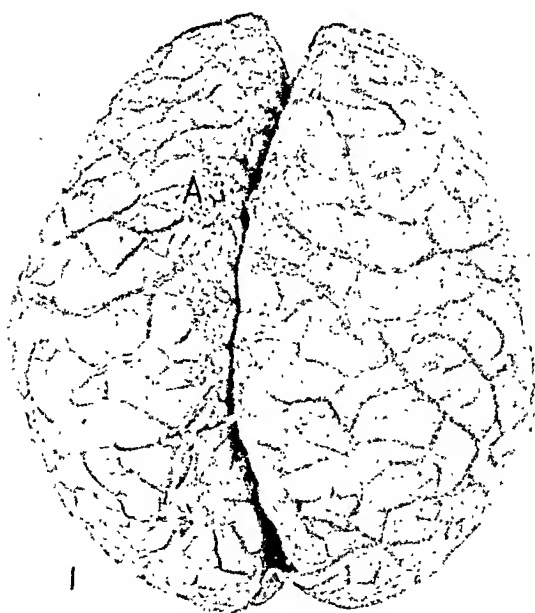


Fig. 1. (Drews and Minckler). Superior view of brain. Note flattening of gyri, absence of free blood in the obliterated subarachnoid space. A, arachnoid granulation.

Fig. 2. Inferior view of brain. Note the large hemorrhage in left frontal pole (H), scattered subarachnoidal blood over the base and stem (S), thickened arachnoid and hemorrhage at the foramina of Luschka (L).

1,370 grams. The gyri are somewhat flattened but there are no basal-pressure markings (figs. 1 and 2). The arachnoidal membrane is thickened diffusely and has a bluish cast. There is no fresh or old subarachnoid blood in evidence over the vertex or sides. The superficial cerebral veins are moderately distended. There is clotted hemorrhage in a subarachnoid position over the medial and inferior aspects of the left frontal lobe. The basal arachnoid is conspicuously thickened and

hemorrhage with marked tenacity of the subarachnoid trabecula. The increase in trabecular consistency in the entire basal cistern (c. interpeduncularis, basalis proper, chiasmatis, and fissurae lateralis cerebri) is marked. This space (fig. 2) dissects with unusual difficulty and incorporates old blood diffusely throughout the trabecular reticulum. This network is interpreted as being not wholly related to the terminal hemorrhage but *incident to previous basal pathology* (arachnitis from



recurring subarachnoid hemorrhage or possibly meningitis—see history).

On the inferior surface of the left frontal lobe there is a gross hemorrhage measuring 2.5 cm. in diameter which dissects into the left cerebrum (fig. 2). Dissection of the basal region reveals the source of the hemorrhage in the circulus arteriosus. There is a gross defect of the anterior communicating artery (fig. 3). The right

Distal to the communicating branch the left artery divides immediately into superior and inferior branches. The anterior communicating artery is disposed in two closely related divisions, an anterior and a posterior bridge. The latter arises as a small branch of the right, and a dilated conical segment of the left anterior cerebral arteries. The anterior bridge has a wide base on both longitudinal vessels



Fig. 3 (Drews and Minckler). Enlargement showing right carotid artery (C), right and left anterior cerebral arteries (ra, la), the aneurysm at the site of the anterior communicating artery (An), the point of rupture of the aneurysm (R), the stellate branching of the left anterior cerebral (br), and the invading frontal hemorrhage (H).

anterior cerebral artery continues past the anterior communicating branch in a normal manner. One small lateral branch is given off at the level of the communicating artery and the distal ramifications are in normal order. The left anterior cerebral artery has a stellate distribution at this level. Laterally, four small vessels are contributed to the brain substance.

and fuses widely in its central part with the posterior bridge. The middle fused part extends in an infundibuliform manner superiorly and to the left, terminating in a rounded bulb with a firm white consistence suggestive of a sclerotic plaque. Inferiorly, the stalk of the aneurysm is in evidence with an aperture communicating with the interior of the artery and

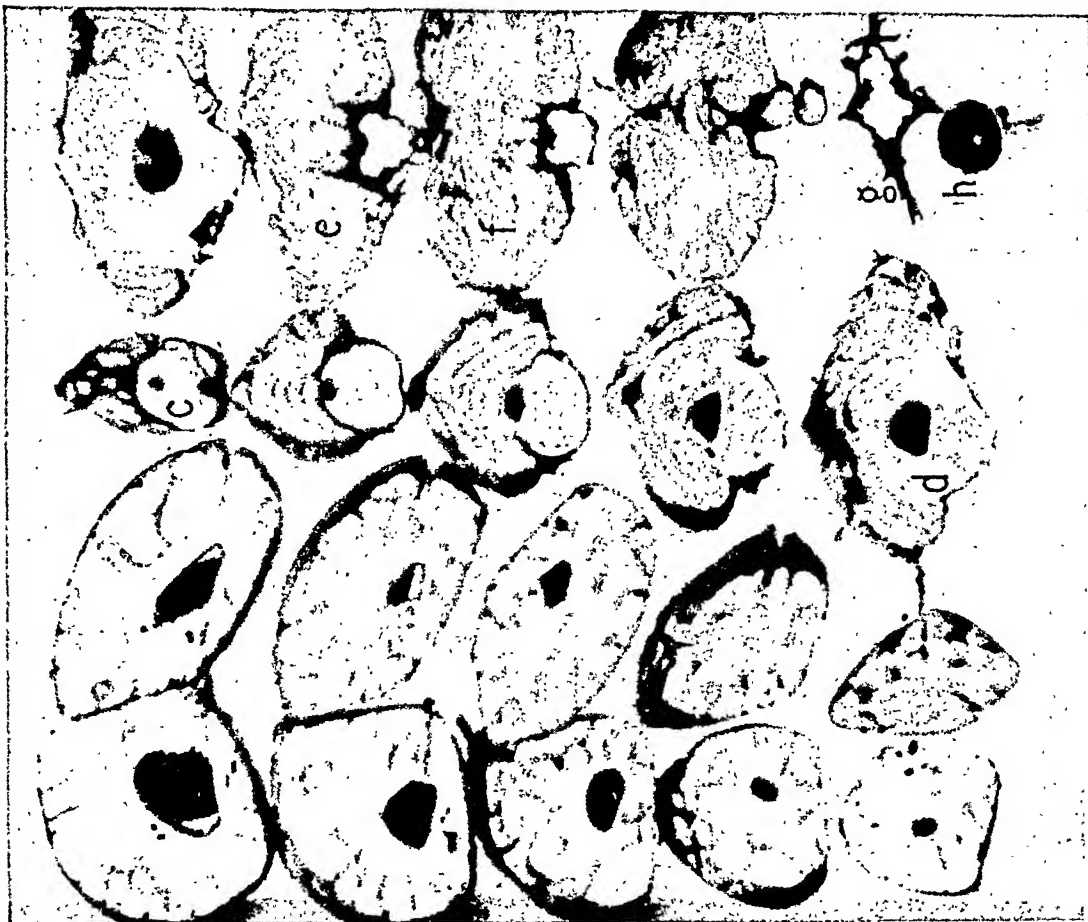
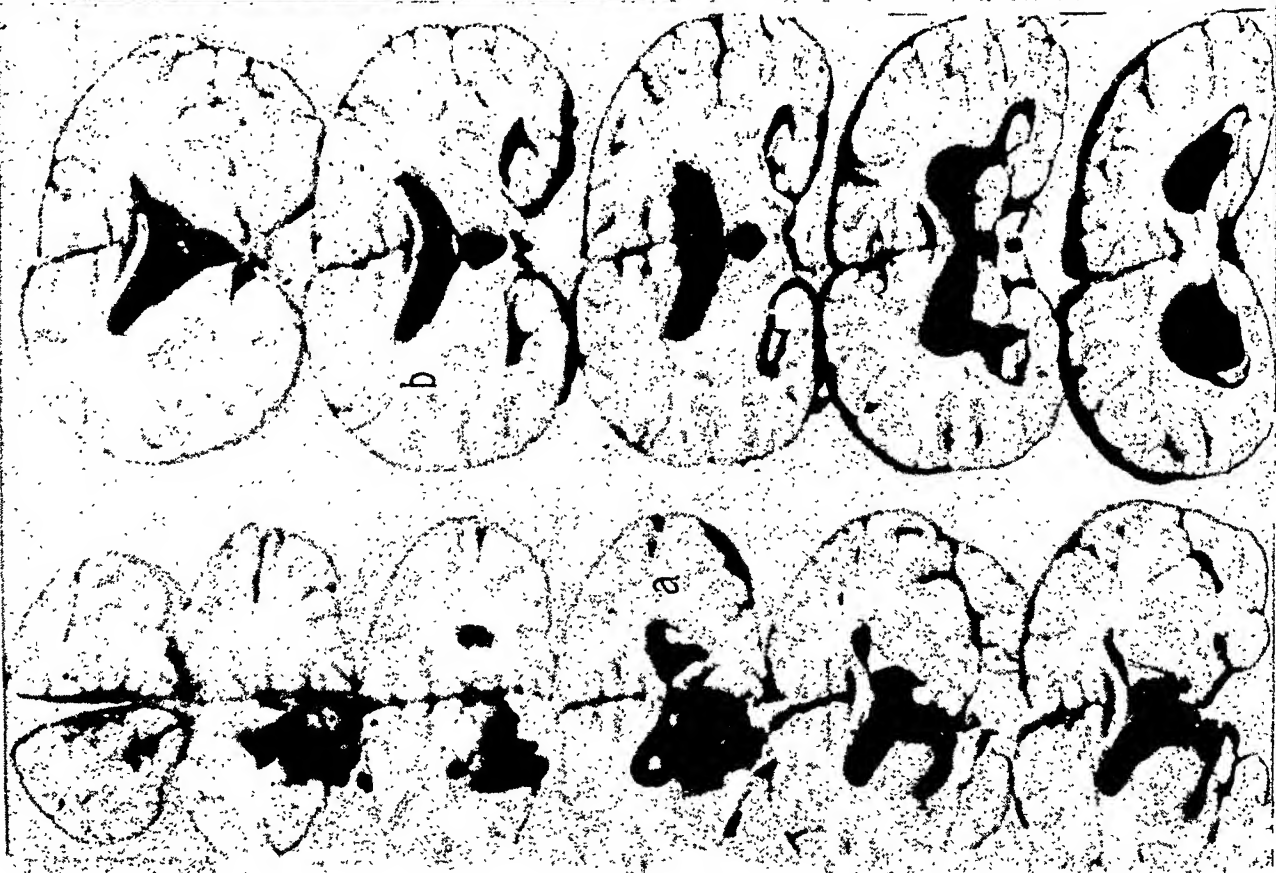


Fig. 4 (Drews and Minckler). Coronal sections of the forebrain and transverse sections of the brainstem showing the disposition of the hemorrhage within the brain. Note the point of entry into the left anterior ventricular horn (a), the obliteration of the septum pellucidum and confluence of the lateral ventricles (b), the continuity through the aqueduct and 4th ventricle (c, d), and through the foramina of Luschka and Magendie (e, f). The dissected arterial circle and removed segment of cerebellum are shown (g, h).





pointing anteriorly and to the left (fig. 3). It is from this aperture that the hemorrhage had its origin, dissecting superiorly into the substance of the left frontal lobe.

Gross coronal sections (fig. 4) reveal the course of the hemorrhage throughout the ventricular system. Entering the

ous seepage of the aneurysm influenced the course of the hemorrhage through brain substance and the intensity of the packing of blood in the ventricular system.

**MICROSCOPIC.** Sections through the aneurysm show a uniform defective wall with great hypertrophy and absence of an

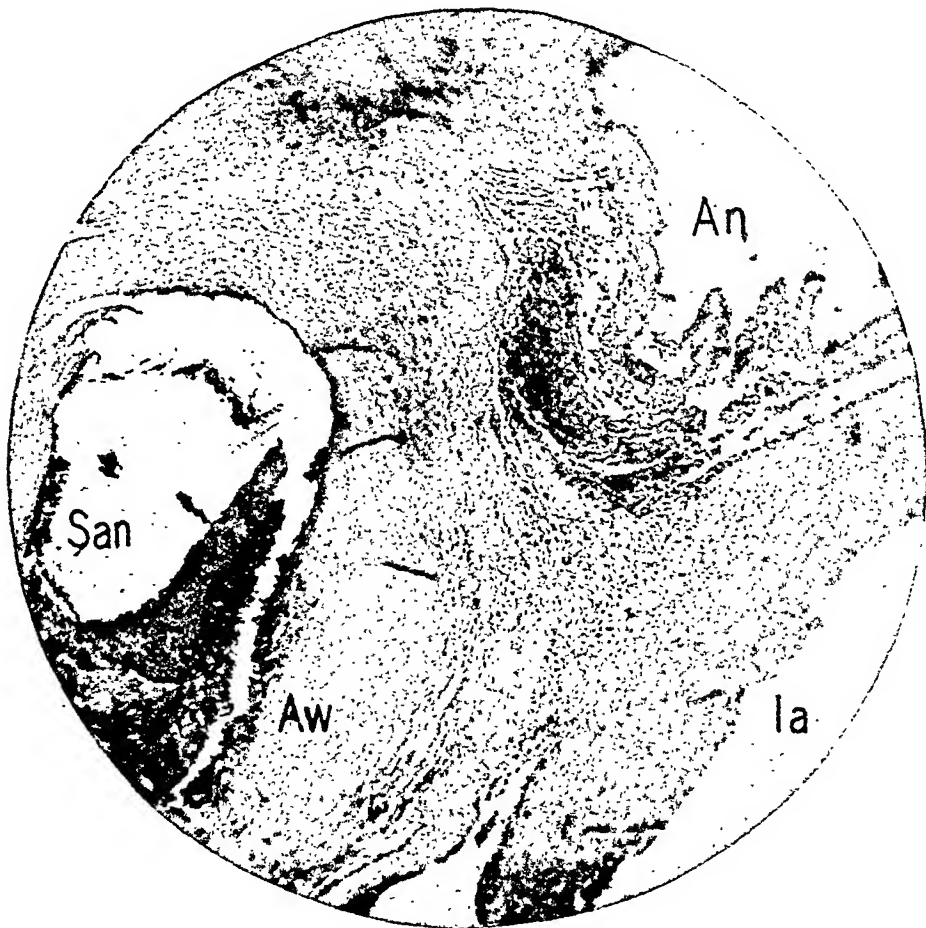


Fig. 5 (Drews and Minckler). Low-power view of section through floor of ruptured aneurysm (An), the superior infundibular extension of the aneurysm (San), the left anterior cerebral artery (la). Note the defective wall of the aneurysm (Aw).

left anterior ventricular horn the blood perfused the entire system, establishing confluence of the lateral ventricles by destruction of the septum pellucidum, and issuing through the lateral and median apertures of the fourth ventricle to appear in the subarachnoid space of the brain stem and cord. Undoubtedly, the arachnitis in the basal cistern from previ-

elastic membrane (fig. 5, cf. Forbus<sup>16</sup>).

*Meninges and brain:* The arachnoidal membrane is thickened, cellular, and compressed over levels including vertex, lateral surface, base, stem, and cord. Free blood is present except as noted grossly. Meningothelial phagocytic activity is pronounced in the subarachnoid space of the spinal cord, less marked at the levels

of the stem and base. At these levels the trabecular network is dense, with free red blood cells and lymphocytes in the meshwork and relatively few macrophages with pigmented debris. The pia-glial membrane is thick and sclerotic throughout. The intramedullary pathology is not remarkable. There is no evidence of glial,

bulb reveal *free blood in the subarachnoid space in diminishing quantity as the inspection is carried distally*. Close to the chiasm there is free blood with numerous macrophages. Red cells are present in progressively smaller amounts to about the midpoint of the stalk bilaterally (fig. 6). Distal to this point no free cells have

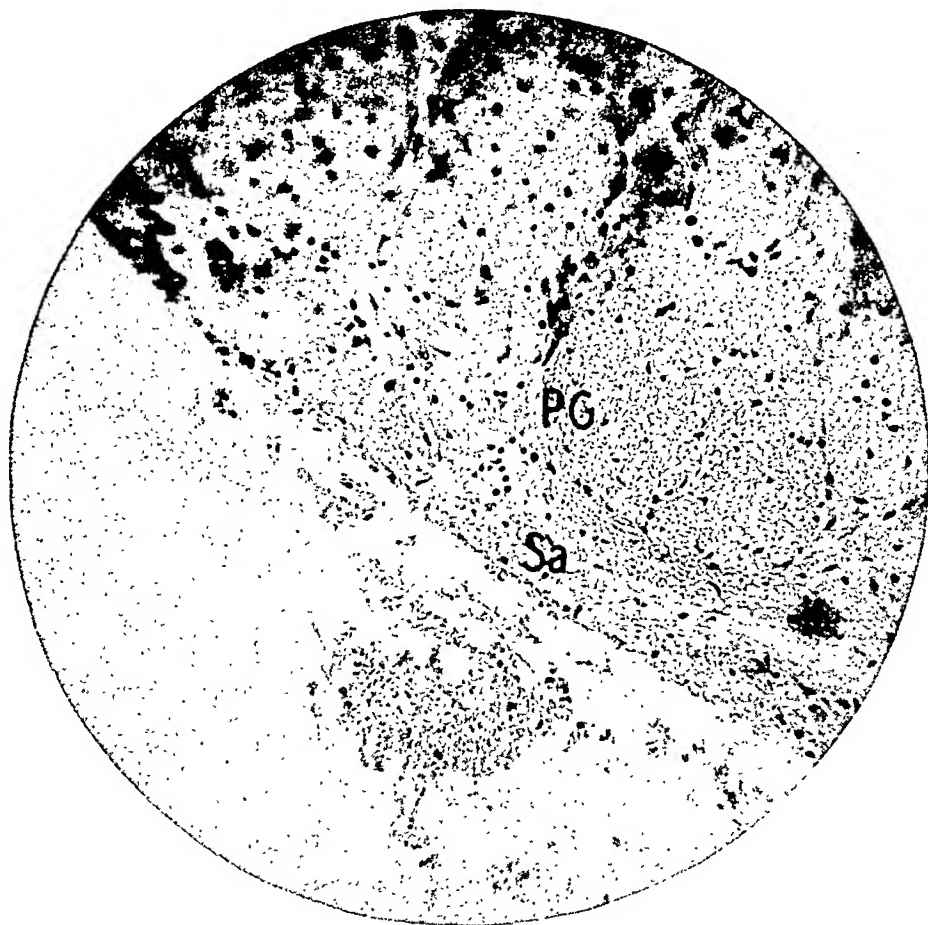


Fig. 6 (Drews and Minckler). Section through the left optic nerve 2 cm. from the chiasm showing free blood in subarachnoid space (Sa). PG, pia glial membrane.

free-cell, or vascular activity suggesting an inflammatory process. Cell changes are nonspecific. The intramedullary small arteries show a minimal medial hypertrophy. Edema is evident but not marked in cerebrum and stem, is absent in the spinal cord and minimal in the optic chiasma. The edema does not extend into the optic nerves. Transverse sections through the latter to within 1 cm. of the

been found but *old hemorrhage is indicated by the presence of scattered macrophages containing pigmented debris*. The arachnoidal space close to the bulb is dilated and shows increased density of trabecula (fig. 7).

Longitudinal sections through one papilla show dilated central vein and moderate lateral shift of the retina. There is a slight forward bulge of the anterior com-

ponent of the lamina cribrosa. Distortion of fibers entering the nerve is not marked (fig. 7). There is an extensive intraretinal hemorrhage (fig. 8). This has dissected into the anterior part of the nerve fiber layer and at all points appears to be separated from the vitreous by a thin,

#### COMMENTS

When I first saw this case I was struck by the fact that the retinal hemorrhages were far more extensive than any I had ever seen in cases of thrombosis of the central retinal vein, or, for that matter, anywhere else. One might think, as actu-



Fig. 7. (Drews and Minckler). Low-power view of one half the papilla showing lateral shift of retina (R), moderate distortion of nerve fibers entering the optic nerve (N), dilated central retinal vein (V), dilated subarachnoid space (Sa). The anterior fibers of the lamina cribrosa bulge forward slightly. Note absence of blood in an interfascicular position at the level of the lamina cribrosa. The relative position of intraretinal hemorrhage (H) is shown.

but distinct membrane of varying cellular-ity (fig. 8). Careful search reveals no actual breach in the wall of the retinal vein but the wall is obviously defective adjacent to the hemorrhage with evident diapedesis. The nerve-fiber layer is edematous and the ganglion cells show a vacuolar change with eccentricity and pyknosis of nuclei.

ally stated by Riddoch and Goulden and quoted before, that where the vein is completely blocked, as in thrombosis, we should see the most extensive venous or capillary hemorrhage possible. Komoto<sup>17</sup> described a preretinal hemorrhage 7 by 10 mm. in size (that is about 5 by 7 D.D.) centered over the macula, and not in contact with the disc, in a fatal case of pur-

pura. I have not been able to find any case in the literature where the retinal hemorrhage was as extensive as in the case here described. Of course, I suppose where hemorrhage is as extensive as in this case it is unusual to find it limited to the retina; in most cases, undoubtedly, it

the hyaloid, forcing its way into the vitreous, even if the blood does travel over the perivascular spaces. If such a hemorrhage, coming through the disc, is to be localized as a preretinal hemorrhage it must be that it is easier to extravasate beneath the internal limiting membrane than

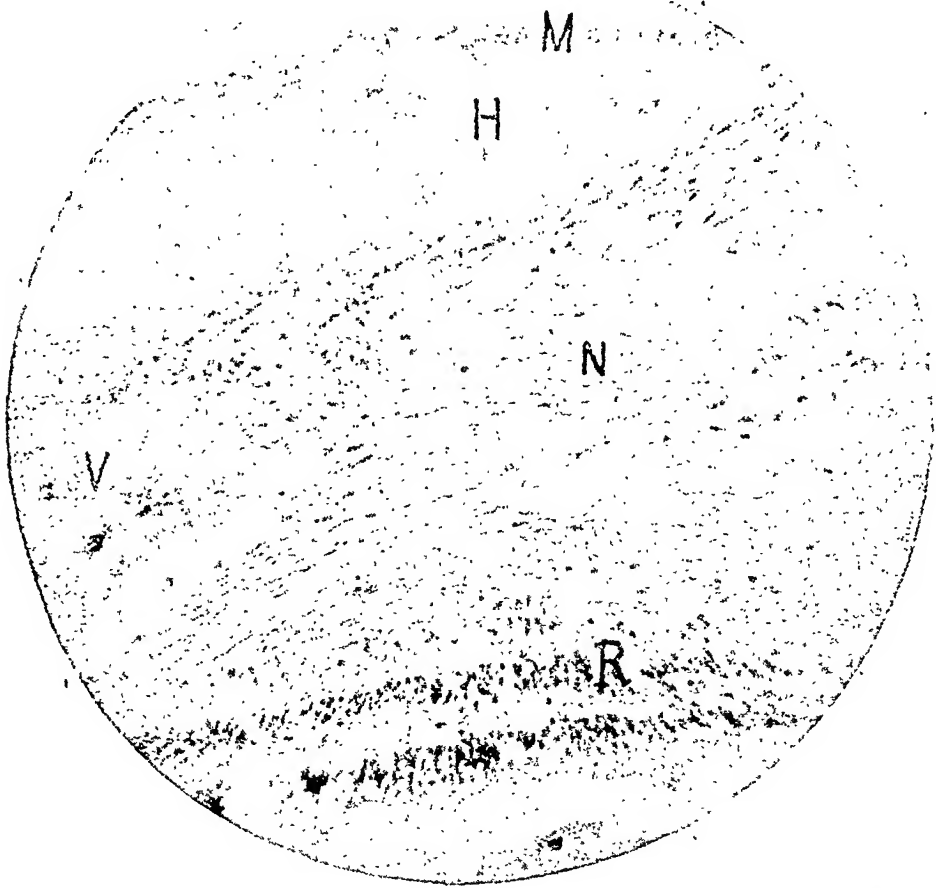


Fig. 8 (Drews and Minckler). High-power view showing retina (R), edematous nerve-fiber layer (N), intraretinal hemorrhage (H), separated from the vitreous by a cellular membrane (M). A retinal vein with a defective wall adjacent to the hemorrhage is shown (V).

bursts into the vitreous, making ophthalmoscopic examination impossible.

It seemed to me that if blood ever were forced through the lamina cribrosa into the eye, this would be a case where such a finding could be expected. In this connection one might wonder why a pressure sufficient to force blood into the eye through the nerve substance and lamina cribrosa would not immediately rupture

to break it and the hyaloid. Moreover, if the blood came through the disc one might expect to find some blood in the canal of Cloquet.

The hemorrhages were described in the first examination as "retinal or preretinal." It was thought that even if they were preretinal the gravitational effect diagnostic of preretinal hemorrhages would be absent because of the patient's

prone position. The smooth outline between hemorrhage and normal retina also suggested preretinal hemorrhage. There is considerable confusion between the terms preretinal and subhyaloid. I have used them interchangeably. In this case, which had some of the characteristics of preretinal or subhyaloid hemorrhage, the hemorrhage actually seems to be entirely *beneath the internal limiting membrane*, which is intact but separated from the nerve-fiber layer by some old hemorrhage and detritus. Some authors have reported that preretinal hemorrhages actually lie beneath the internal limiting membrane; others have found the preretinal hemorrhage located between the internal limiting membrane and the condensation membrane of the vitreous. Duke-Elder<sup>18</sup> says that "usually the blood is poured out beneath the internal limiting membrane which it finds little difficulty in stripping off and raising up so that it forms a film immediately *overlying the retina*; sometimes, however, the internal limiting membrane may be ruptured in which case the hemorrhage forms a similar film between it and the vitreous; and occasionally blood bursts through the face of the vitreous and forms a diffuse opacification in the gel." If the internal limiting membrane is actually formed by the expanded ends of the sustentacular cells of Müller it seems strange that it could easily be detached. Unfortunately only the posterior half of the one eye was removed; therefore, the eye specimen is not all that could be desired. Both optic nerves and the chiasma, however, were removed.

From a clinical standpoint it seems certain that since all the gross *retinal* hemorrhage which had been so extensive was resorbed in only six days or less, the blood was situated in a location having very good circulation. It has often been re-

marked that a large preretinal hemorrhage may be absorbed (and unfortunately recur) with surprising rapidity, but if the hemorrhage actually were situated between the internal limiting membrane and the vitreous, one would not think it likely that it could be rapidly absorbed. Unless there were multiple large tears through the internal limiting membrane it is difficult to believe that there could be a rapid absorption of a truly preretinal hemorrhage. However that may be, it seems certain that, theoretically at least, a large hemorrhage entirely beneath the internal limiting membrane could be rapidly absorbed, whereas a similar hemorrhage between the internal limiting membrane and the vitreous probably could not. In the possible rapidity of absorption, therefore, we may have a suggestion as to the exact situation of a hemorrhage, which appears to be "preretinal."

It seems unfortunate to call hemorrhages beneath the internal limiting membrane either "preretinal" or "subhyaloid" since the hemorrhage really is intraretinal. An intraretinal hemorrhage should be expected to give rise to more retinal damage than a truly subhyaloid one, therefore there is clinical value to differentiation between the two types of "preretinal" hemorrhages. However there seems to be no way in which the two types of hemorrhages can be distinguished ophthalmoscopically, so the use of one term for both conditions seems advisable.

At the autopsy I was rather chagrined to find no gross hematoma of the optic-nerve sheath. Microscopically, we found no hemorrhage in the sheath; there was a small amount of blood in the sheath near the chiasm. This raised the question whether or not there ever was any subarachnoid hematoma of the nerve. All we can say is that we did find moderate hydrops and considerable detritus in the

subarachnoidal space of the nerve, *which was due to hemorrhage* (see pathology report). When one recalls that the very large preretinal hemorrhage was all absorbed, so far as could be observed with the ophthalmoscope, within 6 days, it seems quite certain that even an extensive subarachnoidal hemorrhage into the nerve sheath could have been absorbed within 24 days, the period of time between the onset and the fatal attack.

If the first subarachnoidal brain hemorrhage produced a hematoma of the nerve, why did the fatal attack 24 days later fail to do so? There may have been minor attacks in between the first and fatal attacks as well, as indicated in the history. Perhaps the fatal hemorrhage did not have time to penetrate into the optic-nerve sheath; but probably what happened was that the extensive adhesions in the cisterna basalis and chiasmatis caused by the first hemorrhage prevented the fatal hemorrhage (and any others which may have intervened) from reaching the optic-nerve sheath.

In some personal discussions, there has been disagreement that a large preretinal hemorrhage in each eye associated with subarachnoidal hemorrhage of the brain justified the diagnosis of subarachnoidal hemorrhage of the optic nerve. However, I believe that the literature substantiates the validity of my conclusion that large preretinal hemorrhages in each eye in a patient not the victim of general vascular disease, associated with the typical spinal-fluid findings in subarachnoidal hemorrhage, do justify the diagnosis of subarachnoidal optic-nerve hematoma, even though in this case the actual hematoma was not found to be present 24 days after the onset. None of the reported cases in the literature failed to show such a hematoma; but also none of the reported cases had the time intervals reported here.

The specimen shows slight but definite papilledema; whether this was present beneath the "preretinal" hemorrhage when first noted no one could possibly say. I have no clinical doubt that it was. No one could possibly deny, however, that the papilledema could have been produced by the supposed later hemorrhage with increased intracranial pressure, or even by the fatal hemorrhage.

The autopsy revealed only minimal arteriosclerosis, yet the patient had been diagnosed hypertensive by two competent practitioners. It is an interesting question to ask whether she had periods of acute hypertension related to minor attacks of bleeding from the aneurysm, similar to the acute hypertensive attacks she had while in the Hospital. The sclerosis of the renal arterioles seemed sufficient to account for a hypertension.

*The crux of the problem of massive preretinal hemorrhage associated with hematoma of the optic-nerve sheath in subarachnoidal hemorrhage is that such massive hemorrhage is so unusual in papilledema associated with brain tumor.* What is there about subarachnoidal hemorrhage which favors preretinal hemorrhage? Certainly we would not think that the pressure in the subarachnoidal space would be so very different in the two conditions, and even if it were very different it would still not account for hemorrhages more extensive than those usually seen in actual thrombosis. Of course, in speed of development the two conditions may differ. The more one ponders this the more sympathy one has for Liebrecht, Doubler and Marlow, Symonds, White, and Paton's opinions, which apparently we must discard, that the retinal hemorrhage comes directly from the nerve-sheath hemorrhage. The fact that the pre-retinal hemorrhage may not be in contact with the disc at any time of its development as well as the absence of his-

tologic proof, makes this opinion seem untenable.

### CONCLUSIONS

1. A case of very extensive bilateral preretinal hemorrhage, associated with subarachnoidal hemorrhage from a congenital aneurysm of the communicating branch of the anterior cerebral artery, is reported. When examined pathologically, 24 days after the onset of the brain hemorrhage, only the remains of hematoma were found in the subarachnoidal space of the optic nerves. It is concluded that hematoma had been present but was absorbed.

2. It is suggested that if a "preretinal" hemorrhage absorbs very rapidly the hemorrhage probably is situated beneath the internal limiting membrane where the cir-

culatation may be excellent. Such a hemorrhage really should be considered intraretinal, since the internal limiting membrane is considered a part of the retina.

3. After one or more subarachnoidal hemorrhages, adhesions may form in the cisterna basalis on one or both sides; a later hemorrhage may then fail to produce ophthalmoscopic signs in one or both eyes.

4. As far as I can find this case presents the largest preretinal type of hemorrhage described in the literature (about 10 disc diameters, each eye). There was no evidence that blood had been forced from the supposed hematoma of the nerve sheath through the lamina cribrosa.

5. Why do massive preretinal hemorrhages occur in subarachnoidal hematoma of the optic-nerve sheath frequently, and rarely in ordinary papilledema?

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# EPIDEMIC KERATOCONJUNCTIVITIS FROM A SUBJECTIVE VIEWPOINT\*

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*Chicago*

The present epidemic of keratoconjunctivitis, although slightly different from certain epidemics described under the heading "Superficial punctate keratitis," should, in my opinion, be considered in the same category. The Editor of the *American Journal of Ophthalmology* (1943, v. 26, Feb., p. 199) agrees with this opinion. I have read many of the articles on both subjects. In several of them reference is made to the fact that clinical assistants became infected, but nowhere could I find that a physician had written of the disorder from the subjective standpoint. For this reason it has seemed important to bring before you a slightly different angle of the problem than the purely objective one, which has been adequately presented in numerous recent papers. Also, it has seemed to me expedient to personalize the danger to physicians, and especially ophthalmologists, of infecting their own eyes. One of our Chicago ophthalmologists fell prey to the disease last summer, but very few others knew about it until after I contracted it early in January. Since my illness I have tried to spread the gospel of meticulous cleanliness from Chicago to Mexico City.

The objective signs need not be reviewed here in detail; briefly they are a gradually increasing conjunctival hyperemia and folliculosis, moderate to severe conjunctival edema, some sticky secretion, no pus, occasional pseudo-membrane, slight photophobia, considerable edema of the lids, and regional adenopathy; later often superficial corneal spots varying greatly in size, density, and numbers;

seldom iritis. There is a gradual return to normal, as a rule in three to six weeks, except that the corneal spots linger and usually interfere with visual acuity for several months.

Subjectively, I have had a peculiar mixture of the scientific attitude of the practicing physician with the irritation of the restless patient, which is certainly not scientific. I found myself making my own diagnosis (a most dangerous procedure) and wanting all the corroboration I could get. I did what physicians universally deplore and discountenance; that is, I consulted many physicians and compared their diagnoses and recommendations.

I had seen, December 24 and 28, 1942, a patient (E. P. E.—D1369) with a most peculiar conjunctivitis. He had been in the hospital under the care of a very competent ophthalmologist for about a week, but his doctor had been called out of town and he came to me. In addition to the conjunctivitis, which was moderately severe but without much edema, he had a definite aqueous beam, seen with the slit-lamp, and some fine precipitates on Descemet's membrane. I looked carefully at the cornea with the slitlamp, and I believe I would have seen any superficial corneal spots if they had been present. On January 12, 1943, after he had seen several other ophthalmologists, he went to Dr. H. Gradle's office, and by that time he had developed the corneal opacities characteristic of the disorder.

About January 10th (Sunday)—that is, 13 days after I last saw E. P. E.—I noticed a slight watering of my own right eye, and the following day a stickiness of the eyelids. I have such sensations one or twice a year, and I have found

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a single application of 1-percent silver nitrate usually suffices to restore the tissues to normal in 24 hours. This time, however, the situation did not improve but was even worse on January 12th (Tuesday) at which time, by coincidence, I attended a luncheon at which the subject of this epidemic was discussed. That evening I went to a nearby ophthalmologist, who made a smear and a culture; the clinical appearance was that of an ordinary conjunctivitis but without much discharge; the laboratory report was "no organisms found."

The next day, January 13th, the eye was distinctly worse. I called Dr. Peter Kronfeld, who admitted it might be the epidemic form, and we decided I should go to the hospital to minimize the danger of contagion at home, and so that studies could be more conveniently conducted. The laboratory report of scrapings of the conjunctiva was: "few staphylococci; few larger structures which look like staphylococcal cells; a number of eosinophiles." On the following day a more critical study was made of another smear; several observers noted "a preponderance of monocytes." About January 14th (Thursday) the eyelids began to be heavy, especially the upper one, and the following day subconjunctival hyperemia was marked and the right preauricular gland was palpable.

One-percent, later 0.25-percent, formaldehyde ointment was used in the left eye to prevent, if possible, its involvement; and in the right eye to see if it would have any effect. It was not, however, used consistently because of the discomfort it caused. I dropped 5-percent sulfathiazol solution into each eye six or seven times a day for the first week; also aqueous mercurochrome 1-percent several times a day for three days, 13th, 14th, 15th. Warm boric-acid compresses were used at first, but cold compresses seemed much more comfortable. Foreign-protein therapy was received as follows: (a) Pro-

teolac 5 c.c. intramuscularly, January 14th and 15th; (b) 50,000,000 triple typhoid vaccine intravenously, January 16th—it produced a chill and fever (temp. 101.6°F.) and what the colored folk call "a misery" for 36 hours.

I made it a point to have a paper handkerchief for the right eye on the right side of the bed or chair, and one for the left eye on the left side; two towels also and two handkerchiefs; but I caught myself wiping the left eye with the same towel and handkerchief I had used for the right eye, and this not just once but several times! It was most difficult to develop suddenly an entirely new technique for cleaning my face!

About January 18th the left eye began to tear and the next day a slight sticky secretion was present. Within a day or two the left preauricular gland became tender. It was hard to say just when it became tender; I felt for it many times every day; the onset of tenderness was almost imperceptible.

On the 23d of January minute subepithelial corneal spots were found in the right eye by Drs. Harry Gradle, Sanford Gifford, and others. Up to this time the visual acuity had not been affected. On January 18th Dr. Kronfeld had sent a request to Dr. Sanders at the Presbyterian Hospital, New York City, for some convalescent serum. This was not immediately available; it seemed much longer than the four days it was before it arrived on January 22d. On that day I was given 50 c.c. intravenously; the dose was repeated the next day, and that evening I started to Texas, as it was quite evident I would be out of circulation, as far as my practice was concerned, for another month. On the train I found it difficult to read, and my morale was pretty low when, between trains at Saint Louis, I called on Dr. Hayward Post. The following day newsprint and the menu could be read only with the help of a

+13.00D. magnifier. Tobacco smoke was unbearable, so I had to stop smoking and keep away from others who smoked.

Two days later, January 27th, I arrived in Houston and immediately saw Dr. Everett Goar. He found my visual acuity varied between 18/200 and 20/100; it was not constant and it was about equal in the two eyes. There were still some preauricular tenderness and moderately severe hyperemia of the eyes, but the edema was less. Dr. Goar started me on vitamin C intravenously (cenolate, an Abbott preparation of ascorbic acid), 200 mg. daily. At that time it was very difficult to read, even with a magnifier, and I had to approach to within 10 to 12 feet of a street sign to read it. Even the spots on playing cards were not distinguishable beyond 12 inches. All lights were multitudinous and extraordinarily dazzling and confusing. Neither a single nor a multiple pinhole disc was of any avail in reducing the discomfort from the lights, although dark glasses were helpful. But even with this poor vision I had no difficulty in crossing streets or on uneven pavements.

After the first two treatments it seemed my visual acuity improved, and I thought I could notice the difference within an hour after a treatment. After the fifth treatment the vision was about 20/70, occasionally even better, and I began to wonder if I could get some pleasure out of the experience—possibly a trip to Mexico City even!—that is, my morale rose. But from the time I left Houston the progress was so slow and so often there would seem to be a regression (fresh spots?) that I became very much discouraged and arranged for immediate return to the States in spite of the fact that Dr. Silva reassured me that all would soon be well. Dr. Ramon Castroviejo saw me just as I was leaving Mexico City and did his best also to cheer me up.

Even back in Houston, February 6th to 12th, the improvement was slow.

Acuity varied between 20/40 and 20/30+. It seemed to vary from hour to hour. I attended a clinic with Dr. Edward Griffey and had to admit I did not see details clearly enough to hazard a diagnosis. However, in the dark room I found, with the electric ophthalmoscope, that my acuity was almost normal. Again my morale picked up and as there had been no secretion of any kind for 10 days I left for home, determined to do my best whatever happened.

During the last few days in Houston I had started dionin 5 percent in each eye daily. This I continued for nearly a week. Then all treatment was stopped. I had had 200 mg. cenolate (ascorbic acid) intravenously daily for 17 days. When I arrived in Chicago, February 14th, the acuity was 20/30± and 20/20±, R and L, respectively, with my correction, and this could not be improved by any change in the glasses. The lights were still multitudinous, each one being surrounded by many others, but the halo was not so glary and the single center light or object was more clearly defined. Those who examined my eyes with the slitlamp said they saw that the spots were thinning out—that is, each one was less dense. The progress has continued and now after 10½ weeks, I no longer have halos, my vision with correction is 20/20+ with each eye; the "spots" can still be seen by any keen observer in each of my corneas. I think I can say I have recovered my mental and emotional equilibrium. I can never forget, however, how angry and disgusted I was with myself for the careless moment when, after examining my patient and before washing my hands, I must have fingered my own eyelids.

Entirely from the subjective standpoint I would say cold boric-acid compresses, intravenous vitamin C, and encouragement were the factors I found to be most helpful.

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# TEMPORAL ARTERITIS\*

## CASE REPORT WITH EYE FINDINGS

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Arteritis of the temporal vessels was originally described by Horton, Magath, and Brown<sup>1</sup> of the Mayo Clinic, in 1934. They reported two cases and concluded that this form of a localized arteritis was a previously undescribed entity. The next case of this condition was reported by MacDonald and Moser,<sup>2</sup> in 1937, the further history of whose case is described by the present authors. Three months after the report of this case, Horton and Magath<sup>3</sup> reported a total of nine cases in the literature, seven of them being their own. These cases were so similar, both clinically and pathologically, that they again concluded that this was a new disease entity. This contention has been accepted by most authors, the number of cases now in the literature being approximately 26.<sup>4-14</sup> With few exceptions these cases have been reported in this country, but three were seen in England,<sup>4-5</sup> and one each in Uruguay,<sup>3</sup> France,<sup>6</sup> and Canada.<sup>9</sup>

The disease seems to be limited to elderly persons, the youngest reported being 55 years old. The onset is characterized by headache, which is more or less constant and which tends to be more severe at night, general malaise, weakness, fever, anorexia, and loss of weight. From two to five weeks after onset the temporal arteries become very prominent and tortuous, with inflamed raised nodules along their course. They are very painful and tender to the touch, this condition being present to a lesser extent over the whole scalp. In the early stages pulsations are

present, but these disappear as the condition progresses. The temperature usually ranges from 98°-103°F., and the white-blood-cell count from 7,500 to 13,500, with a reduction in the red-blood-cell count to around 3,500,000. Usually there are no other significant physical findings.

The disease generally runs a chronic course of four to six months' duration, the patient being often bedfast for long periods, but never dangerously ill. Pain in the head is usually the most marked complaint. Complete recovery has occurred in every case on record. There is no specific treatment. However, the symptoms in most cases are completely relieved by removal of portions of the temporal artery for biopsy.

The pathologic picture is characteristic and serves to differentiate this condition from periarteritis nodosa and rheumatic arteritis. Pathologically the lesion is a chronic periarteritis and arteritis. There is an infiltration of round cells in the adventitia around the vasa vasorum and in the media of the larger vessels. This infiltration is present to such a marked degree in some areas of the media that complete necrosis with hemorrhage is present. In the areas of destruction of the media it is replaced by a granulomatous type of lesion in which many giant cells are invariably present. The intima in most places is much thickened. This reaction usually reduces the lumen to a marked extent, which in many areas is completely occluded by thrombi. The gross nodular areas represent the cellular infiltration around the vasa vasorum. The etiology is unknown, but the inflammatory appearance of the lesions suggests a low-grade infection. The advanced age suggests that

\* From the Department of Ophthalmology, Washington University, and the Oscar Johnson Institute. Read at the seventy-ninth annual meeting of the American Ophthalmological Society, Hot Springs, Virginia, June 10-12, 1943.

degenerative changes in the arterial walls may be a factor.

The following report of a case of temporal arteritis does not represent an addition to the total number in the literature, as this case is the third to be reported, having been described previously by MacDonald and Moser<sup>2</sup> in 1937.

#### REPORT OF CASE

The patient, a white housewife, aged 66 years, was examined by Dr. L. D.



Fig. 1 (MacDonald and Moser). Low-power cross section of temporal artery, showing inflammatory reaction in the media and a marked proliferation of the intima ( $\times 20$ ).

Thompson of Saint Louis on July 8, 1941, because of failing memory and mental deterioration.

*Past history* (an abstract of the case as reported in detail by MacDonald and Moser<sup>2</sup>). The patient entered a hospital in Indianapolis on March 1, 1935, because of pain in the temples, fever, sweats, and general malaise. About four weeks before she had noted a tender area in front of the right ear. About a week later the left side of the face became swollen

and tender. At this time she became aware that the temporal arteries were prominent, red, and tender. General malaise and weakness were pronounced, and fever and sweats were present every night. Her past history was of no importance in this connection.

*Physical examination* at this time revealed the left temporal artery to be very prominent from a point just above the temporo-mandibular joint for a distance of about  $2\frac{1}{2}$  inches. It was thickened, tortuous, the caliber irregular, and the surrounding tissue hyperemic. Pulsation was present throughout the course of the vessels at the time of the first examination, although this became very much diminished a little later. The right temporal artery was less acutely involved, but pulsation was definitely diminished. The preauricular and postauricular glands were enlarged and tender. Two teeth were found to have periapical abscesses. Both optic-nerve heads appeared normal, and the retinal vessels showed about the usual change for her age. The heart was not enlarged. The blood pressure was 148/90. There was a definite pulsation felt in the suprasternal notch. The remainder of the examination was essentially normal.

Except for a slight anemia, the blood examination and serology were normal. Later urinalysis was normal, although a faint trace of albumin and a few casts were noted shortly after admission. X-ray studies of the chest showed the heart to be of normal size.

On March 29th a section of the right temporal artery (three centimeters) was removed for histologic examination. This showed marked hypertrophy of the intima, almost occluding the lumen, with a scarcity of nuclear elements and tendency

to hyalinization (fig. 1). The media showed almost total destruction and replacement by inflammatory cells of fibroblastic variety. Upon the external border of the media in certain zones were huge multinuclear giant cells. (fig. 2). The adventitia was atrophic. Following the removal of this segment, the temperature became normal and remained so until the patient left the hospital one week later. The patient reentered the hospital on May 13th. She had gained much strength and her general appearance was much improved. She had no fever after the first week. The incision over the right temporal artery was healed. The left temporal artery was smaller and showed no pulsation. It still showed some evidence of inflammation. The eyegrounds were normal. The remaining physical findings and the laboratory examinations were as at first admission. After dental extraction, the patient was discharged.

She was again seen on August 6, 1935, at which time she stated she felt well in every way. The blood pressure was 160/110. The left temporal artery appeared normal, and a normal pulsation was present. At this time there appeared to be an increased narrowing of the temporal vessels and more pulsation in the suprasternal notch. Examination in June, 1936, showed essentially the same findings as the year before.

*Interval history.* The patient had remained entirely well until two years ago when some mental deterioration was first noted. This had been characterized by memory defect, periods of aphasia, some intermittent depression, and general slowing of mental activity. There had been some tendency to slow progression.

*Physical examination* (July 8, 1941). The patient was perfectly oriented and rational, but reacted quite slowly. There was a smoothness and lack of wrinkles in the

face suggestive of Parkinsonism, but there was no tremor. There were one or two devitalized teeth. The tonsils were barely visible, the remainder of the pharynx being normal. There was some scarring in either temple, but no inflammatory reaction was present. The thyroid gland was not unusual. The right carotid



Fig. 2 (MacDonald and Moser). High power through wall of temporal artery, showing chronic granulomatous inflammation in media ( $\times 150$ ).

was definitely dilated. A pulsating mass could be felt extending 2 cm. above the right clavicle, probably an aneurysm of the innominate artery. This was confirmed by fluoroscopic examination, which showed a definite widening of the base of the heart with a pulsating area extending from the right border of the arch into the neck. Over the aneurysm the second heart sound could be heard clearly. Blood pressure was 182/104 in the right arm and 186/112 in the left. There was widening of the heart at the base, particularly toward the right. Sounds, rate, and rhythm were normal except for an accentuation of the second aortic sound. The lungs showed a moderate amount of

emphysema, but were otherwise normal. The examination of the abdomen, pelvis, and extremities revealed nothing unusual.

*Laboratory examination.* Red-blood-cell count was 4,220,000 and the white-cell-count 7,600. Differential blood count showed segmented forms 54 percent, stab

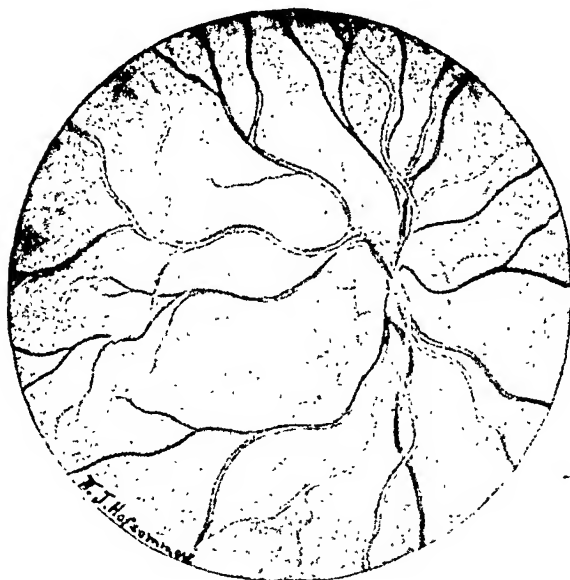


Fig. 3 (Post and Sanders). Fundus drawing, right eye.

forms 5 percent, lymphocytes 38 percent, and eosinophils, monocytes, and basophils 1 percent each. The fasting blood sugar was 76 mg. percent. The Kahn test was negative. The basal metabolic rate was -14 percent. The urine was acid with a specific gravity of 1.010, and was negative for albumin and sugar. The microscopic examination showed only an occasional white blood cell. X-ray examination of the skull showed a questionable erosion of the floor of the dorsum sellae, and that of the chest a cardiac enlargement with a definite widening of the supracardiac shadow.

The patient was also examined by Dr. A. B. Jones, a neurologist, who reported that the patient was merely an "old woman," older than her years, with no localized findings. He thought the findings were due to cerebral arteriosclerosis.

*Ophthalmoscopic examination* was done July 9, 1941, by one of us (L.T.P.). The patient had no ocular complaints. The vision was normal, glasses being worn for close work only. The patient's husband was in the hospital because of detached retina, and the ophthalmoscopic examination was done as a matter of interest in view of the past history, and not at the request of the patient, who did not desire an eye examination since she had no eye symptoms. On being informed that the eyegrounds were unusual, she consented to having photographs made of them. The media were clear. The discs were of good color and outline. The arteries showed a marked sclerosis with irregularity of caliber and thickening of the walls approaching the copper-wire stage. In the right eye along the course of the superior temporal artery above the macula were two areas of apparent sheathing, the larger being about one disc diameter in length, the smaller, one half its length, being near the disc. Other similar lesions were noted in the peripheral branches of this artery, and another small area in the superior nasal artery adjacent to the disc. In these places the arterial wall seemed to have undergone a fusiform thickening which was deep red in color. The reflex over these areas was markedly impaired, and the blood column could not be seen. The surrounding tissues showed no reaction nor scarring. Below and nasal to the macula were three confluent areas of silvery exudate. They had indefinite borders, the whole area being about the size of the disc. There was no inflammatory reaction present. No hemorrhages were noted (fig. 3). The left fundus was not unusual except for the sclerosis of the vessels.

On March 28, 1942, it was found that the general condition was somewhat improved on general supportive treatment. She was complaining of some inability to



control the flow of urine. Dr. D. K. Rose found a hyperplastic urethritis which was treated by fulguration in Barnes Hospital on April 3, 1942. At this time the general laboratory findings were essentially as noted previously. The appearance of the fundus of the right eye was essentially unchanged.

The patient died very suddenly of a cerebral hemorrhage on September 12, 1942.

#### COMMENT

Although many of the cases of temporal arteritis described in the literature have definite eye findings, very little attention was given this phase of the condition until several months ago, when Johnson, Harley, and Horton<sup>14</sup> reported three cases in which there was marked loss of vision. In their first case a quadrant field defect was present in one eye with nothing in the fundus except a few ischemic areas to account for the loss. In the other eye the vision was reduced to light perception only, with occlusion of some of the upper branches of the central retinal artery and ischemic elevation of the upper margin of the disc. In the second case the vision of the right eye was limited by a corneal leucoma to perception of hand movements. The fundus of this eye was not unusual except for mild arteriosclerosis. In the other eye the vision was completely gone. The optic disc was mildly edematous and slightly pale. From the temporal margin an irregular, whitish, slightly raised region of exudation extended outward about one disc diameter. Several small hemorrhagic extravasations were present along the superior nasal vessels and above the disc. Several days later there was a sudden, complete loss of vision in the right eye, with no apparent local cause. The patient in the third case had no vision in the right eye and 3/30 in the left. The fundus of the right eye revealed a

rather pale disc, mildly edematous, with an area of localized edema of the retina between the disc and macula in which there was a slightly reddened area suggestive of a cherry-red spot. The optic disc of the left eye showed one diopter of edema and the lower temporal quadrant appeared rather pale. The veins were engorged. The authors concluded that in these cases the mode of onset of loss of vision suggested occlusion of the arterial blood supply of the retina or optic nerve. The evidence of occlusion in the retina was insufficient to explain the complete loss of vision, so this must have occurred in vessels too far back to produce fundus lesions.

In the other cases reported, the eye findings are mentioned only incidentally and in relatively little detail. Even so, approximately one third of the cases in the literature show some significant eye lesion. In the series of seven cases reported by Horton and Magath,<sup>3</sup> two cases presented "evidence of phlebitis of one of the retinal veins with hemorrhages and exudates" and one patient had diplopia. In one of the cases reported by Jennings,<sup>4</sup> the left eye was completely blind on admission, having suffered a gradual loss of vision for one week. The disc was pale, with small central hemorrhages, and the retinal arteries were narrow. The right eye was normal at this time, but within six days a similar picture developed in this eye with complete loss of vision. The diagnosis of the eye consultant was bilateral obstruction of the retinal arteries. Bain<sup>5</sup> stated that in his case there were severe photophobia and bilateral "peripapillary atrophy." Both of the cases reported by Dick and Freeman<sup>7</sup> presented blurred vision. In their first case, the vision of the right eye had been poor since birth. During the course of the disease "the vision in the left eye became blurred. The optic disc was twice the normal size

and was slightly edematous. A small hemorrhage was present on the disc. The visual field was reduced to a small point." There was no statement as to the final visual result. Their second patient complained of soreness of the eyes and blurred vision with diplopia for one week. Examination showed "tortuous retinal arteries, sluggish extraocular movements, and poor vision in the right eye." In the case reported by Scott and Maxwell,<sup>10</sup> the fundi were normal at the onset. The patient was also found to have a diabetes with a high renal threshold. About two months later she was complaining of loss of vision in each eye, more in the right. The fundus of this eye could not be seen because of opacity in the lens, whereas the left showed no change in the arteries, but numerous small patches of exudate were seen in the peripapillary area.

In the experience of both authors of this report the fundus picture in this patient seemed unique. To our knowledge no similar arterial lesion has been previously described either in temporal arteritis or in any other vascular condition. The nearest picture approaching the appearance of this fundus was seen in plate 56 in the Wilmer Atlas. The plate is entitled "retinal arteriosclerosis," but from the description there had been a marked loss of vision apparently from an occlusion of the arterial blood supply occurring at the time of a cerebral hemorrhage. In another plate of the same eye (no. 26), made three months later, the localized arterial lesions had disappeared, but a marked generalized attenuation of the retinal vessels was present with glaucoma.

The exact nature of the localized arterial lesion seen in our patient presents a problem in interpretation. It does not seem to be an area of acute inflammatory arteritis related directly to the lesion in the temporal artery, as it did not take place for some months after the temporal

lesion occurred. Also there was no evidence of periarteritis or reaction in the surrounding tissues, as would have been expected in the case of an acute inflammatory lesion, the changes here being localized in the wall of the artery. From the appearance of the fundus alone, the best conclusion is that arterial changes are on a degenerative basis, but this does not explain the brilliant-red color of the localized areas. Whether inflammatory or degenerative, the lesion at this stage must have been relatively inactive as the appearance of the arteries was unchanged after eight months. The area of exudate could be an infarct caused by an occlusion of a small branch of a retinal artery. It is obvious that the arterial degenerative changes are not restricted to the retina, for the patient had an aneurysm of the innominate artery and had marked cerebral sclerosis, dying of a cerebral hemorrhage. It is possible that the whole fundus picture could be explained on the basis of the patient's arteriosclerosis and hypertension, although the appearance of the local lesions is unique.

Despite the fact that eye lesions are very commonly seen accompanying temporal arteritis, we believe that no particular one is characteristic. The two commonly seen are occlusions of the central retinal artery or larger arteries, and a localized arterial lesion with hemorrhages or exudates not unlike those seen in certain cases of arteriosclerosis. It is also possible that certain fundus changes diagnosed as arteriosclerotic might be degenerative similar to those seen in this patient.

We also agree with the statement made by many other authors that the arterial disease is not confined to the temporal and ophthalmic vessels, but is scattered extensively throughout the vessels of the body, especially those of the head and neck. We are inclined to believe that the



condition is fundamentally a degenerative one, which at times undergoes a localized acute inflammatory phase, this being particularly prone to occur in the temporal

vessels. The fundus picture in our case may represent one stage of inflammation in a retinal artery.

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# MILITARY OPHTHALMOLOGY\*

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In the Military Surgical Manual of the National Research Council for Ophthalmology and Otolaryngology,<sup>1</sup> the Surgeons General of the Army and of the Navy set forth a fact that is not yet fully grasped by the profession at large. They have not strongly emphasized the fact that the overspecialization which has taken place since the last war cannot be carried over into the military and naval services. They have, through the medical departments of the Army and of the Navy, placed the ophthalmologists in their special work to a remarkable degree. Speaking as a veteran of two major and several minor wars and having no inhibitions and no reason to tone down the hard necessities, I must tell you that the services need doctors, great numbers of them. When a major engagement takes place, all the doctors in the world would not be sufficient.

The need for experienced specialists is largely confined to base hospitals and hospitals in the home country, also to the large Army Posts and Cantonments. It is clear, therefore, that, compared to the total number of doctors in the service, there is need for relatively few ophthalmologists. It must be obvious also, that many ophthalmologists will have, of necessity, to become Army surgeons, in any field, no matter how far removed from their specialty. Our specialization has become too narrow. The use of ophthalmologists for purposes other than ophthalmology is not purposely done by the Army and Navy. It is a military necessity.

The stern necessity of war has reduced the previous physical standards includ-

ing those for eyes. Before the attack on Pearl Harbor by the enemy, our standards were those of peace time, when physical perfection was more or less required. We had a great population from which to draw and a pitifully small Army that had been neglected and starved of necessities in the matter of modern equipment. There was, as has ever been in our history, a neglect of preparation for the inevitable. The result now, as always, is terrific waste of lives and material and money. The hurried building of enormous fighting forces on land and sea necessarily results in confusion and waste in time, effort, and the lives of our sons and resources. The pacifists, the "sob sisters," the spirit of "I did not raise my boy to be a soldier," some of the educational institutions that exercised very considerable antimilitary and antipreparation-for-war influence, have done us irreparable injury, not to speak of the lesser influences such as birth control and alien peoples among us who have quietly, skillfully, and continuously undermined our morale; all enemies of the Republic, dangerous and destructive. Thanks be to Almighty God, such influences are being successfully combated; for example, by the introduction of some control in the educational institutions whereby physical education will be enforced on the student body, something that has been almost entirely neglected.

And what has this to do with ophthalmology? Much, very much; if you would have good eyes, without which a man is so seriously handicapped in the armed forces as well as in civilian life but to a lesser extent, those eyes must be in a strong and vigorous body. Such vigor can result only from physical training of the whole student body from the first

\* From the Department of Ophthalmology, The George Washington University School of Medicine. Read before the New York Academy of Medicine, January 18, 1943.

grade in school to the end of the senior year in college—not from specialized training given to a few superathletes to make a team with which to advertise the university at the physical expense of the team and, worse, of the student body. A shortsighted and selfish attitude indeed.

We may not like the arbitrary methods of the military, but this very moment it is those methods that are saving this country from being overrun by savage fiends, infinitely worse than the hordes under Genghis Kahn who overran and destroyed the civilization of that day. We should be thankful, indeed, for the wisdom, foresight, and patriotism of those who established the military and naval academies, which are not excelled in the world, to give us young men trained thoroughly, mentally and physically, trained in patriotism first and thought of self afterward. Would to God our educational leaders had taken a page from history and had had the good sense to apply it to their institutions years ago. What a different situation would have presented itself now! There would have been many tens of thousands of stout fellows, well educated and disciplined; thoroughly alive to military necessity through study of the military history of our country. The educational institutions of our country have been sadly lacking in the preparation of the youth entrusted to their charge for the greatest of all tests that comes at least every generation. Because of this, certainly in part, many have been rendered physically unfit for military duty because of weak and undeveloped bodies, often with resulting defective eyes. It is our duty as members of the medical profession to combat these evil influences; it is our duty as ophthalmologists to combat the too-long hours in hot school rooms, too little physical training, and too much home work. The young people have insufficient time for out-of-doors exercise

and proper hours of sleep during their adolescence, the time they need it most. This is preventive military ophthalmology, and we should work for it and fight for it. The first graders who are suffering such insults from the schools must be the fighting men of tomorrow. Have we a greater duty than to do our best to abolish our system of faulty education and erect a sounder one in which the development of the body takes equal precedent with the development of the mind?

In speaking of delayed mustard-gas lesions, Philips<sup>2</sup> describes patients as saying that they had been symptom-free for 10 to 20 years, had continued work, and had apparently suffered no visual disability. From the onset of the delayed keratitis they experienced rapid deterioration of sight.

From a somewhat limited experience in treating eyes that have been damaged by strong alkalis and acids, it would appear that the course of disease in eyes with severe mustard-gas burns follows a rather close parallel: slow degeneration ending in phthisis bulbi. There may or may not be pain, although pain is likely to be suffered at intervals.

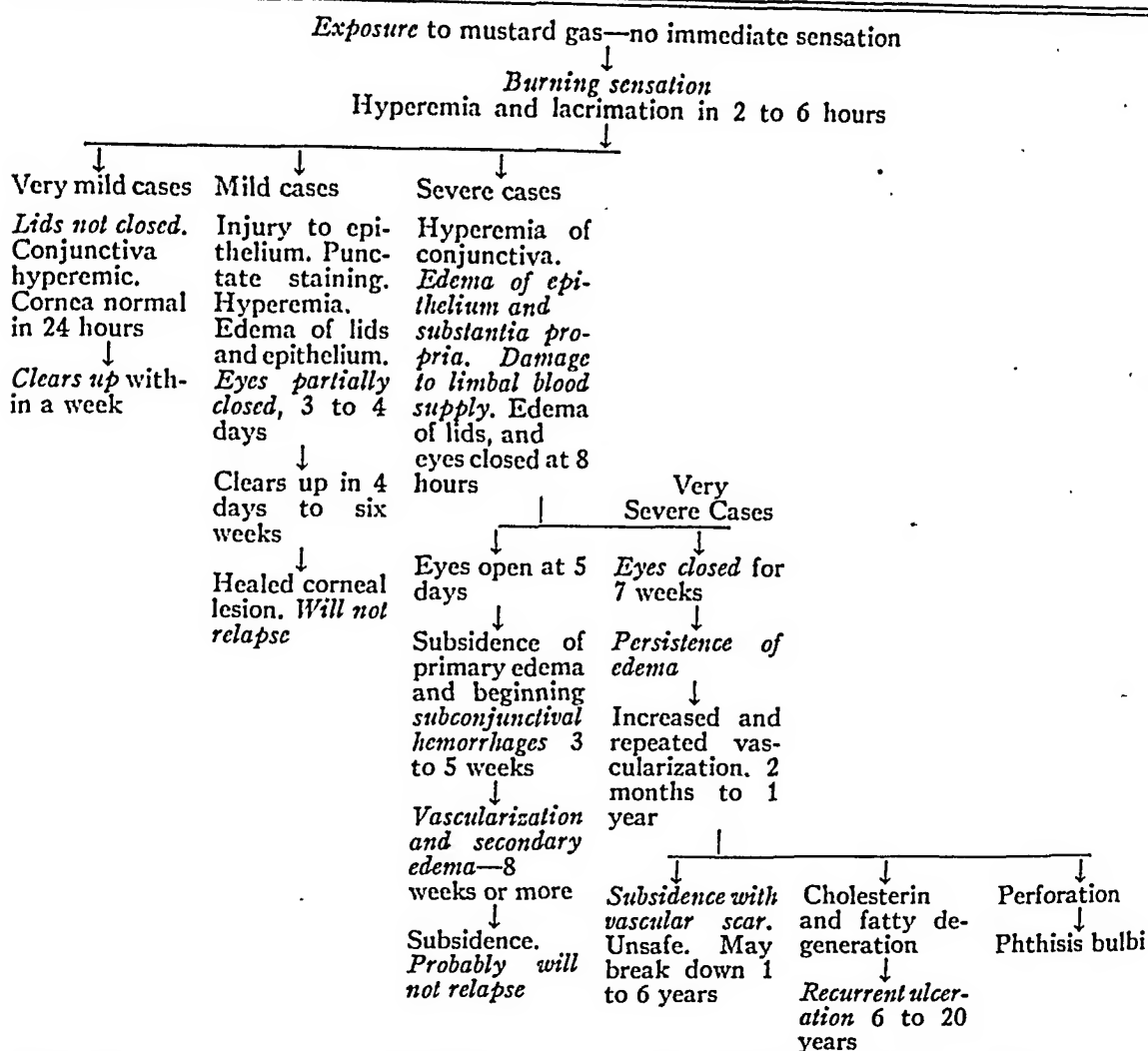
Dr. Ida Mann<sup>3</sup> states that the clinical pathology in mustard-gas lesions in man and in rabbits is about the same. Since the life of a rabbit averages 10 years, she believes she can calculate the course of the disease following mustard burns closely in man as to time of the various developments ending in destruction of the eye. This, of course, takes into consideration the relative expectancy of life of the two animals, rabbit and man. The conclusions are as follows:

1. The clinical pathology of the lesion involving the limbus is similar in man and the rabbit.

2. The reaction in man and the rabbit is dependent on the size of the dose and the anatomic situation. The effects of

TABLE 2\*

COURSE OF MUSTARD-GAS LESIONS IN MAN, COMPILED FROM OBSERVATIONS ON 65 CASES



vapor and liquid are different only when the actual amount of mustard gas that soaks into the tissues is different; that is, the difference is quantitative only.

3. The late keratitis in man is seen as a degenerative ulceration depending on the initial damage sustained by the limbus and cornea, and not on any continued action of mustard gas or any of its breakdown products.

4. From conclusion 3, it follows that, in the present state of our knowledge, prophylaxis is likely to be much more important than treatment. It is very difficult to assess the value of treatment in

man, since the dose of mustard gas received can never be known and no two cases will be comparable. Two eyes of the same patient may be comparable, though by no means is this always the case, even when the lesions are due to vapor.

#### EYE INJURIES

Love<sup>4</sup> states in a personal communication that since our troops have engaged in only a limited amount of combat and since the statistical material has not been compiled, little information is available at this time regarding combat injuries of the eyes in the Army.

\* From Mann and Pullinger. Amer. Jour. Ophth., 1943, v. 26, p. 1276.

With reference to the prophylactic measures, it was recognized early in the emergency that protective goggles were necessary for the armed forces. Consequently, a type was adopted and since that time has been furnished to all the troops in armored divisions.

About December, 1941, the War Department adopted the policy of furnishing spectacles to all military personnel that required their use. To facilitate the furnishing of spectacles and the replacements for them in the theater of operations, mobile optical units have been organized.

Steps have also been taken to provide corrective lenses for the gas mask for such troops as require them.

Lenses of plastic are being developed.

In a personal communication Matthews<sup>5</sup> says that ophthalmic injuries in the Franco-German War were 1.18 percent of all wounds. In the Russo-Japanese War they were 2.2 percent. In World War I they were 5.2 percent. The percentage in this war is exceeding this figure.

Duthie<sup>6</sup> observes that (1) the injuries to the eyes have, generally speaking, shown the same characteristics as those in civil practice; (2) they are mostly extremely severe types of injury; and (3) the advances made in the general treatment of casualties have shown that it is unwise to think that recovery of such severe injuries is unlikely. Meticulous treatment is indicated.

#### INJURIES TO THE ORBIT

When a foreign body in the orbit is giving no trouble it is wise to leave it alone. The disfiguring injuries of the face are largely in the hands of the plastic surgeon, but ocular symptoms, particularly diplopia, are of significance, as they usually indicate a more severe type of lesion. The prognosis depends on early

diagnosis and early manipulative treatment. Collaboration of the plastic surgeon with the ophthalmic surgeon is of great value.

#### LIDS

Every type of laceration may be seen; severe burns are the most important problem. "Tanning" does not give good results with the lids, as it is too rigid and causes too much contracture. It is better to use the gentian-violet silver-nitrate technique. Skillful nursing is necessary to care for the conjunctival discharge that frequently complicates such cases. Stelard's conjunctivo-dacryocystotomy is of much value. Early plastic repair of the lids is of great advantage and should be done where the military situation permits.

#### BURNS

Thermal burns are far greater in this war than ever before. They accounted for 60 percent of all casualties at Pearl Harbor. The principal factors are, according to Matthews,<sup>5</sup> the ignition of oil or gasoline aboard ship; the use of highly volatile gasoline for all purposes; and the incendiary bomb and the flame thrower. The face and the hands are mostly involved. At Pearl Harbor many of the men on our ships had on only trousers. They had burns from the waist up, the face and hands and the feet, as the latter were bare. "Aviator's burn" is the term given to flash burns of the face and hands from the explosion of gasoline vapor in the cockpit. Diminution of the burns of the eyes might be avoided by the wearing of goggles. Personally, I know from service in combat with soldiers, marines, and sailors that it would be most unlikely that they would have them on at such a time and there is no time to put them on when combat starts.

The antifeash gear (asbestos gauntlets and hood) is used successfully. Matthews<sup>5</sup>

remarks that the men object to wearing it in the tropics. I would deem it almost impossible to wear such things in combat in the equatorial heat.

Gifford<sup>7</sup> estimates the extent of corneal burns by noting the transparency of the cornea and the intensity of the corneal staining with fluorescein.

General, widespread burns may coexist with the eye lesions, and the ophthalmologist should be fully informed of the procedures used in such situations.

For burns of the lids Wakeley<sup>8</sup> recommends the use of 1-percent gentian-violet jelly with merthiolate; aboard British vessels it is immediately available and easily applied in combat. Suturing the lid margins is of value in assisting in the prevention of contracture and also in corneal injuries at the front. Powdered sulfanilamide becomes caked; the granulated form less so, and hence, it is better. Mixtures of sulfanilamide and mineral oil were used at Pearl Harbor with satisfaction. A 5-percent aqueous emulsion without bandaging is recommended by Matthews.<sup>5</sup>

An interesting fact is that sailors immersed in the sea for hours after torpedo attacks with burns, show the wounds to be clean and to heal satisfactorily. This I found to be a fact in the Moro campaigns in Mindanao. This was jungle fighting such as we are again having in those beautiful tropical isles. Our soldiers suffered from terrible knife wounds when we would be many days' or weeks' march from the coast. The wounded men would have to be carried on litters made of bamboo and rattan by the natives. Proper care could not be given; the wounds would often become infested with maggots. Upon their return to the base hospital or even to the beach I would wash these wounds in sea water; not boiled but taken from the ocean in a sterile container if one was available; often I would place the patient in the sea so that the gentle waves would

wash over him and then allow him to lie in the sun on the beach to dry. These wounds would be clean, and if it were possible to have aseptic sutures they would heal by first intention. I think sea water from clean oceans in the tropics has a valuable aseptic effect. It also is soothing, cleansing, and is isotonic with the blood serum.

#### FOREIGN BODIES

Matthews mentions the great differences in foreign bodies in the globe from World Wars I and II. So far in this war there is a greater incidence of non-magnetic metallic fragments due to the substitution of aluminum and magnesium alloys for brass and steel in the manufacture of bomb and shell cases. These fragments become encrusted after several days and do no harm. Ophthalmoscopically, they may resemble synchysis scintillans when they are very small and numerous.

In one series, in the Polish war, about 4 percent of foreign bodies were in the posterior segment of the globe. The typical signs were a deepened anterior chamber, depression of the iris, folds in Descemet's membrane, intraocular hemorrhage, and subsequent retinal detachment; all of the eyes with this involvement were lost.

In World War I shell fragments were the most frequent causative agents. Now with the use of the aerial high-explosive bomb, flying débris is the chief cause. In cities, glass is the most important; such foreign bodies are difficult to localize. Falling shrapnel of friendly anti-aircraft fire also accounts for many casualties. Larrange (quoted by Matthews) analyzed the orbital and ocular wounds of the last war with the following observations. Missiles passing above the orbit, injuring the frontal bone, produced fractures in the region of the optic foramen and superior orbital fissures, causing disorders of the motor and optic nerves without injury

to the eyeball itself. Missiles passing below the orbit often produce retinal injuries by concussion, usually affecting the macular region. Where any of the orbital walls are crushed, concussion injuries of the globe are likely to occur with chorio-retinal laceration and subsequent retinitis proliferans and retinal detachment. Such detachments are rarely amenable to surgery. They differ from those detachments due to recurrent retinal hemorrhage. Proliferation stems from the ruptured choroid in the injury cases. Doherty, as quoted by Matthews, noted that unusual conditions obtained in war are: (1) spastic blepharospasm and entropion caused by irritation of the infraorbital nerve, usually from a retained intraorbital foreign body near the apex; (2) avulsion of the optic nerve; (3) enophthalmos due to depression of the wall of the orbit with consequent enlargement of the orbital cavity; and (4) hematic ring of the disc, a sequela of hematoma of the sheaths of the optic nerve.

In military surgery the size of a foreign body is likely to be larger; it is less likely to be magnetic, the period of time before treatment can be instituted is longer and sepsis is more likely to occur. It is obvious that the prognosis is worse in war injuries. It is well to put the eye to the magnet even though the X-ray picture is negative, since more than one foreign body may be within the globe. My personal experience with foreign bodies in the globe has not been a happy one. Most of the eyes are eventually lost from detached retinas, secondary glaucoma, chronic uveitis, complicated cataract, and other distressing sequelae not to mention the possibility of sympathetic ophthalmia. Many of these complications occur very late, several or more years after the injury. Removal of the foreign body may be accomplished, but even though accomplished the end results are often disas-

trous; except for iron and copper it may be best to let them remain.

#### SYMPATHETIC OPHTHALMIA

The risks are much greater if prolapsed and incarcerated uvea is dealt with after some time rather than within the first 48 hours. This is of the greatest importance. Eyes that have had such a type of injury and that come under observation a fortnight afterward should be enucleated if the eye looks sick and has a low-grade uveitis, is soft and with ciliary injection.

Duthie<sup>6</sup> thinks eye work in general hospital suffers, being placed in a secondary position, with which we all agree. He thinks, and I am sure all ophthalmologists will agree, that injured eyes should be in an ophthalmic unit in a general hospital.

In the treatment of eye wounds in combat, which includes air raids and black-outs, first-aid workers and medical personnel are instructed to anesthetize the eye and apply sterile dressings, leaving definitive treatment to more expert ophthalmologists if the surroundings and personnel are conducive to such care.

The differences are reiterated for emphasis: Enforced delays in handling war casualties, as before mentioned, make wound contamination obviously more likely to occur. The coexistence of shock and other serious injuries may place the eye injury in the position of secondary importance. There may be inadequate or no facilities in the field. The last named can scarcely be realized or visualized by those who have not been in combat.

Our military personnel are instructed to observe the following routine in cases of perforating and other severe wounds in the field and combat.

1. Anesthetize the eye with 1-percent butyn or 0.5-percent pontocaine.

2. Gently remove any superficial foreign bodies with cotton-wound applicator moistened with boric-acid solution.



3. Flush the eye with boric-acid solution.

4. Close the eyelids and apply a fairly firm dressing, held in place by adhesive tape.

5. Evacuate as rapidly as possible, so that the patient may receive proper ophthalmologic care promptly.

6. Do not close the wound with sutures.

7. Do not excise any tissue protruding from the wound.

8. Do not cover the eye with a conjunctival flap, unless specifically equipped to do so.

Two German writers are said to have successfully sutured corneal wounds with human hair. They claim better optical results than with a conjunctival flap.

When an eye is destroyed, and bits of uveal tissue are buried in the surrounding tissues, they should be sought for and removed to prevent sympathetic ophthalmia. Early probing in the orbit for bullets or shell fragments is unwise. Infection may be introduced into the orbit or through skull fractures to the meninges.

Grossly lacerated lids may be sutured over the cornea to prevent drying of the latter. Walker, quoted by Matthews, introduced sulfanilamide crystals directly into the anterior chamber in severe lacerations of the cornea at Pearl Harbor. This was done before closure with a conjunctival flap. The results were gratifying. All army personnel carry into combat packets of sulfanilamide on their persons and are instructed in its use.

## CORNEA

Multiple foreign bodies are the most important and the most frequent injury. Subconjunctival foreign bodies had best be let alone. They usually work to the surface; if not, they rarely cause trouble.

If the eye is quiescent when there are numerous foreign bodies in the cornea, it

is best to let it alone rather than attempt complicated or even simple methods of removal, since no irritation is present. Subsequent sepsis is rare. Even if the eye is considerably injected as the result of the explosion of an incendiary bomb, for example, too much interference is probably unwise.

## CONCUSSION

Concussion is frequent and is the result of (1) direct blows on the eye, (2) blows on the bones of the face or orbit, (3) foreign bodies traversing the orbit, and (4) blast.

These were the most frequent injuries of the last war as of this one, and there is voluminous literature concerning the subject.

The various conditions arising from such injuries are iridodialysis or, conversely, rupturing or tearing of the pupillary margin; concussion cataract; all types of intraocular hemorrhages; retinal-concussion changes characterized by large areas of dark hemorrhages; ruptures of the choroid, concentric to the disc, or, more occasionally, a tear radiating from it, and avulsion of the optic nerve.

Intraocular hemorrhages are important; if they are anterior and persistent, secondary glaucoma may supervene. Paracentesis of the anterior chamber is in order. Posterior hemorrhages are sinister. Efforts should be made at once to favor absorption and delay coagulation, thus preventing the formation of solid masses in the vitreous which resist absorption. They may become organized.

A solid clot may cause false light projection although there be no lesion of the retina or choroid. This may lead to the enucleation of an eye that might have the possibilities of restoration of vision.

The patient, according to Duthie,<sup>6</sup> should *not* be kept in bed but should move about. After a considerable period, if ab-



sorption of the clot is not taking place, scleral puncture may be considered. Subconjunctival injections of normal saline may be tried.

#### RUPTURE OF THE GLOBE

The majority of cases are caused by flying splinters and glass. Many globes are completely destroyed; many hopelessly injured. Personally, I think we should make a careful inspection and a more careful decision where there seems to be even a faint hope of saving the eye.

There may be rupture by contrecoup or rupture caused by a foreign body penetrating into the orbit but not the globe and causing rupture by striking the eye itself. If the uvea is extruded it should be cut off. In cases in which there are severe wounds in the ciliary region, in unilateral cases, and in those presenting other intraocular complications, Duthie advises enucleation. This is good advice when we consider the possibility of sympathetic ophthalmia. Nevertheless, I think we should be conservative *where military conditions permit*.

Small conjunctival flaps sutured firmly to the episclera I consider to be better than large ones and also better than scleral suture.

Like myself, Duthie is conservative in the use of sulfa drugs in cases of intraocular sepsis or the prevention thereof. All other aseptic and antiseptic precautions should be followed. The end results of ruptured globes are most frequently very sad in military as in civil practice, and this is the experience of us all. They are likely to be sadder in military medicine than in civil practice for obvious reasons.

It appears best, in the combat elements of the army active in the field, to bandage the injured eye and get the man back to the nearest place where adequate treatment or enucleation can be carried out. This applies to all injuries of the eye of

any moment, except gas injuries, where bandaging is contraindicated. Obviously, the treatment of more than trivial injuries cannot be adequately carried out in a fast-moving combat force. It would seem that the wounded and injured, under present combat conditions, may have to wait long and travel far before they may receive adequate treatment. In the days of marching armies, wagon trains, and no air strafing, the field hospitals were relatively easy of access. Today they may be hundreds of miles away and accessible only by air or rapid motor transportation. There may be no such transportation available for the wounded. Combat calls for everything the army has when a battle is on. The regulations state that so much transportation will be available for the medical department. This is under the direct command of the ranking general, not the medical officer, and he has to win the battle or all are lost, wounded included. Under such conditions the theoretic transportation may be unavailable for a time; hence, it is every man to his job to do the best he can under the worst possible conditions, lack of food, water, shelter, and supplies.

In a personal communication from Dr. Meyer Wiener,<sup>9</sup> honorary consultant in ophthalmology to the Navy, he says:

"I think one of the striking features about foreign-body injuries in this war is the fact that we have not had a single one that was magnetic. Even when they were removed, and looked like iron or steel, they failed to be attracted by the magnet. An analysis of quite a few proved them to contain a large amount of copper. Then we have had a number that looked like aluminum and proved to be such when we had an opportunity to test them. We make no effort to remove aluminum, as it has proved to be harmless, thus far. We had one officer who had multiple fragments of aluminum all over his body, including some in the knee joint, which had to be removed. These were sustained while in action on a destroyer on August 7th during the first battle for the Solomons. One penetrated the left eye. You could see the tract through the cornea, hole in the

iris, tract through the lens capsule and the foreign body in the lens, just above dead center. We left it in. The patient has had no irritation whatsoever and his vision in that eye today is 20/20-1.

There is another boy from the Solomons who had one eye shot out, with multiple fragments in the right eye, some opacity in the lens, bands in the vitreous, and much blood. We have also treated that expectantly, and his vision has gradually crept up from bare perception of light with poor projection, to ability to count fingers at 6 inches and increasingly improving light projection, tested with the lids closed.

As in the last war, we have seen injuries to the retina and rupture of the choroid from concussion, without any visible external involvement. One case was seen recently with a double rupture of the choroid. The worst cases are the ones where the eye has been penetrated by large objects, especially in the ciliary region. Most of these have had to be enucleated. There have been a number of lid injuries which have required plastic repair. Thus far, we have not had to reconstruct any by pedicle grafts. Dr. Lucic got a beautiful result in a case where the lower half of the right upper lid had been burned away by molten metal, by transferring a segment from the opposite eye, including a thin margin from the brow, and reversing it so as to make a row of lashes. I acted as his first assistant. You may recall him as he was at Wilmer Institute for several years before coming here. I think it should be stressed that the all-important thing is to give adequate proper immediate care, which would obviate the necessity of doing many plastic repairs. We had one recently which demonstrated that. We worked on it for over two hours but finally did get a most satisfactory permanent result. Of course, one cannot always do this under actual battle conditions; but it is my belief that if they do not have the time or conveniences, they should clean up things as best they can, do no débridement, and let the fragments fall as they will. They can then be separated later and readjusted. This is naturally only second best.

I think that you should bring up the subject of malingering. Perhaps some of these fellows are not really trying to gyp the Government, but are shell shocked. At any rate, they must be considered, as we have a lot of them. They are easy enough to catch when only one eye is involved; but when it is claimed that both are affected and equally so, it is a different matter. We have one now, who I am convinced is a fakir but feel that he has been so well coached that we are going to have a hard time proving it.

I thought you would be interested in one case we had of arteriovenous aneurysm of the lateral sinus, with marked proptosis, dilatation, and

tortuosity of the vessels, both externally and retinal. Dr. Leonard Furlow tied off the internal carotid, and the swelling is about gone, with almost normal vision. This case was due to concussion but there was no external injury."

Major W. Randolph Lovelace, II,<sup>10</sup> at Wright Field, in a personal communication says:

"The latest work that is being carried on in the Air Corps is that on night vision, color vision, depth perception, and the approaching possibilities of revamping visual requirements for pilots to the lowest limits, commensurate with good performance, rather than the highest possible limits. As far as this laboratory is concerned, I am sure it would be all right to mention the fact that an apparatus is being developed to determine accurately and quickly the degree of night vision present in all flying personnel and that oxygen equipment is being designed so that it can be comfortably used in conjunction with Air Corps goggles. Color vision, of course, is important from the standpoint of detecting camouflage and from the standpoint of night operations."

The different branches of the service naturally have different eye requirements. Those of the Air Force are the most severe, as one would imagine. Incidentally, this leads on to this interesting corollary; there are many investigations and original research problems as well as the results of practical experience which are adding a great deal to our knowledge of the visual act. It is not proper to speak of many facts which have been discovered but they pertain to color vision, night vision, anoxia, and high-altitude flying, and the results on the visual act as to visual acuity both central and peripheral, and disturbances of ocular motility. Much study has been done on dark adaptation. Its importance lies in the necessity for keeping the eyes of the men in the fighting air force dark adapted all the time when they are on duty. It appears that by having them wear red glasses, the dark adaptation is not interfered with and they can see sufficiently well to read while waiting for the call to take off. I am informed that

illumination of the cockpit by red light is better than the "black light"; that is, ultraviolet light acting upon fluorescent dials on the instrument boards.

Dark adaptation and night blindness have received much attention and practical study since the beginning of the war. Much of practical value has been determined. Knowledge of dark adaptation, light sense, and light differences are of great practical use even though the laboratory methods are not satisfactory. Attention is directed to the Military Surgical Manual,<sup>11</sup> where the writer speaks of night blindness and uses the term "war hemeralopia" as applied to soldiers. This did not occur in our Army but did in the armies of Europe who were half starved, as was the whole population, as it is again today. It is, of course, due to avitaminosis A and is curable by the exhibition of this principle when it is available. This manual also deals with diseased eyes with poor night vision and also malingerers and neurotics. Those with diseased eyes would, of course, be quickly discovered and eliminated. Malingerers are subject to court martial and severe punishment, and neurotics do not long exist in a military force. My long military experience taught me this. Malingerers do not last very long when they get into the hands of their comrades, who know full well how to handle them. Incidentally, a good stiff top sergeant is the best cure I know for a neurotic.

#### FACTORS AFFECTING NIGHT VISIBILITY<sup>12</sup> (Military Surgical Manual<sup>11</sup>)

##### A. PURPOSE

For night operations it is essential that troops be trained to avail themselves of all existing means whereby night vision and the ability to observe are improved. All individuals do not adapt their eyes to darkness at the same rate of speed. It is therefore desirable that commanders

know what persons within their organizations have faulty night vision. The ability to see well in the dark is improved by systematic training.

##### B. FACTORS INFLUENCING DEVELOPMENT OF DARK ADAPTATION

1. The time necessary for dark adaptation can be shortened by avoiding bright lights prior to going into darkness.

2. Lack of oxygen markedly decreases the ability of the eye to adapt to darkness. At an altitude of 16,000 feet this reduction is such as to require 10 times as much light to see an object as would be required by the same individual at ground level. Even at 4,000 feet, impairment of night vision is noticeable. Crews of night fighters who are climbing fast should take oxygen from ground level if they wish to make the best possible use of their vision on dark nights. More oxygen than that normally required will not further increase night vision.

3. Persons suffering from a severe lack of essential food factors (vitamins) will show a diminution in their ability to adapt to darkness. In these cases, resumption of an adequate diet or the feeding of vitamins A and D will return the night vision to normal, but an excess of these vitamins will not further improve night vision.

##### C. FACTORS INTERFERING WITH MAINTENANCE OF DARK ADAPTATION

Eyes adapted to darkness will remain so only in the absence of interfering lights. Such a condition, however, seldom pertains in warfare. Light interference may be of many sorts: dash lights, searchlights, gun flashes, flares, and reflected moonlight. Individuals must be made to realize the necessity of avoiding the effects of such factors. Conditions in the combat zone usually dictate that motor movement be made without lights. When

lights are allowed, drivers of motor vehicles should be especially instructed to keep lights within the vehicle at a minimum and to take only fleeting glances at instruments.

#### D. OTHER FACTORS AFFECTING NIGHT VISIBILITY

1. Any form of distraction will result in a less efficient observer. Outstanding among these are the discomforts occasioned by cold, noise, and objects interfering with the field of vision. Fatigue tends to inattention and greatly interferes with night observation.

2. Reducing the contrast between an object and its background detracts from night vision. Anything which scatters some of the light, such as a scratched or dirty windshield, has this effect.

3. In dim lights a large object may be visible when a small one is not. For this reason, night binoculars, designed to admit as much light as possible, help night vision by increasing the apparent size of the object. The use of night glasses is restricted by the fact that they limit to some degree the quantity of available light rays reaching the eye, restrict the field of vision, and must be held without vibration.

#### E. TRAINING IN PROPER USE OF EYES

1. In daylight objects are seen most clearly with the center of the eye but at night this ability to see images most sharply shifts to a position slightly off center. For this reason, during darkness the gaze should be directed about 10 degrees to one side of the field that is being observed.

2. The eye is also subject to fatigue. An object will be most distinct immediately upon looking at it. If, however, the gaze remains fixed upon the particular object it gradually loses its distinct outline and blends with the surroundings.

3. Night observers should be taught to

employ a roving movement of the eyes in a series of short jumps. Nothing can be seen while the eyes are actually in motion, but vision is best just after they have been moved. This fact is of special significance to the air observer. Rapid changes of angle of bank, producing this effect of rapid motion of the eyes may result in failure of a pilot flying a night mission to see an object on one side of his line of flight.

#### F. TEST FOR NIGHT VISION

1. The following rough measurement of night vision may be made by testing men outdoors on a dark night before the moon has appeared. A night will be considered too bright for test purposes if, after 25 minutes of dark adaptation, individuals can read small newspaper type without the assistance of light.

2. Mount on a post at the end of a level space 5 yards wide and 40 yards long and away from all artificial light, a black target on which is a movable white strip 6 by 24 inches. Mark off distances from the target at 5-yard intervals. After the person to be tested has been kept away from all artificial illumination for 25 minutes, direct him to walk slowly from the far end of the test area toward the target. The distance at which he is first able to identify correctly the position of the white strip is noted. While the person being tested is walking back for another trial, the position of the white strip is changed. Several trials are made. Correct recognition should take place at an average distance of not less than 20 yards from the target.

#### G. SUMMARY

1. Instruction designed to improve the ability to observe in darkness will include training in the proper use of the eyes at night and a consideration of those factors assisting or interfering with night visi-

bility. The following points will be especially stressed:

- a. The importance of and factors governing pre-adaptation.
  - b. Proper methods of search and the employment of "off center" vision.
  - c. The detrimental effects of night adaptation of: (1) lack of oxygen at high altitudes; (2) light on the dark-adapted eye; (3) distraction, with special reference to cold, noise, and objects interfering with the field of vision; (4) fatigue; (5) light dispersion, emphasizing the necessity for scrupulously clean windshields.
2. Unit commanders will identify those individuals within their units who possess decreased ability to adapt to darkness, in order to avoid the hazards incident to the injudicious employment of men whose night vision is below the average.

#### AVIATION MEDICINE

The study of the new field of aviation medicine reveals some new facts but mostly known facts widely extended. It is a specialty within itself in that it requires considerable knowledge of several specialties, some of them quite highly technical; for example, like ophthalmology and otolaryngology.

To quote from the Technical Manual,<sup>12</sup> "A defect which may be considered as minor or insignificant in the ordinary walks of life may be serious indeed for the pilot of aircraft." I might add, that we cannot be too careful in these examinations; a slip might cost the lives of all in the plane, the plane itself, and, it is quite possible, the lives of many in the army on the ground. To quote again:

"In all probability there is no other type of physical examination where the time element is so important, where the adage 'make haste slowly' applies more forcibly. A complete ocular examination is at best a tedious procedure and requires an infinite amount of patience on the part of the examiner and the examinee, and, where 'short cuts' are employed or de-

cisions made hastily, the accuracy of the finding is at best questionable. The eye examination should be objective as far as possible. Obviously the type of examination given for this purpose differs greatly from the examination given for clinical purposes. To the trained ophthalmologist, the eye examination is very simple, yet one has to use care that because of its extreme simplicity one does not become careless. This is a small matter, however, since relatively few trained ophthalmologists will be giving these examinations."

Fourteen steps are outlined on page 69 of the Technical Manual in the examination of candidates for flying training in the air service. It might be well to note them: Visual acuity, depth perception, Maddox rod with screen test at 6 meters (please note that it is the rod and screen test, otherwise serious errors will creep in), red-glass test, prism divergence, prism convergence and associated parallel movements, inspection, pupils, accommodation, angle of convergence (not PcB), central color vision, fields of vision, refraction, and ophthalmoscopic examination. It will be noted that this is quite a comprehensive examination for a physician who is not an ophthalmologist. Thus, special training is in order for the flight surgeons.

With the enormous number of flight surgeons required it would seem that perhaps the civilian medical schools and the eye hospitals could greatly assist the armed forces in this rapid education in the basic requirements in ophthalmology, which composes the most highly technical division in the subject of aviation medicine.

#### COLOR VISION

In the matter of color testing and color vision, more instruction should be given in ophthalmologic training. A number of flying personnel are passed by the medical examiners who are "color unsafe." A number of cadets are admitted to West Point whose color vision is defective. This situation is exceedingly dangerous and

slows down the war effort. Likewise, it is casting an aspersion on the medical profession. There is some slight excuse for it in that, so far as I am aware, there is no clear-cut and decisive outline of a method to be used in testing color vision. There are no standardized nor accepted criteria upon which to work. The confusion in the terms used expressing color vision and deficiencies thereof is confounding. Nevertheless, the young ophthalmologist should be taught and required to know the subject well enough to make an efficient color-vision test for the services and to make a proper diagnosis of the deficiencies expressed in proper terms. It would be a real help to the armed services if a pamphlet could be forthcoming expressing briefly, succinctly, and practically, the essentials that the doctor of medicine, making such tests, should know about color vision. Anyone who attempts to inform himself encounters theories as to how color perception is perceived, or different terms meaning the same thing and the same terms meaning different things. Those among you who have not experienced military service can scarcely appreciate what a boon it would be to the armed services, and hence to our country in time of need, if something that is practical and definite could be given to the doctors going into the Army and Navy. A quick and efficient method of testing color vision is a great need. Tests requiring extensive expenditure of time often mean hasty and inefficient examinations and faulty findings.

#### WAR OPHTHALMOLOGY

War ophthalmology differs but little from that of civilian life. The *facilities* for taking care of eye injuries, however, differ greatly. The utmost ingenuity must be exercised by the surgeon in overcoming the difficulties of the situation.

Vail<sup>13</sup> mentions in an editorial that at

base hospitals a thoroughly trained ophthalmologist should be stationed with equipment necessary for extraction of foreign bodies from the eyes and all other care of the injured, sufficiently serious to be returned to the base. This is a problem which has not been answered as yet as to how the wounded that require hospital care can be gotten to the base. I have not the slightest doubt that the medical departments of the Army and Navy have formulated in minute detail the plans for such care. *But*, they are probably largely on paper. Having gone into a world war with probably almost total lack of anything approaching adequacy, good sense will tell us that the medical department of the Army has found it physically and humanly impossible to prepare properly against the vicissitudes of troops in the Arctic, on the Equator, and in the burning deserts, all requiring the greatest difference in the handling of such a colossal problem. How are men with seriously wounded eyes to be transported to a base that in order to be free from bombing has to be possibly a thousand miles away, or across seas, from the combat area? Here can be accomplished the plastic work for restoration of appearance and function, both of almost equal importance. The importance of adequate first aid in the combat zone to prevent infections, of rapid transportation and care en route of the wounded to the base, requires the almost perfect coördination of many departments of the army. With an army suddenly expanded from what was merely a national constabulary in *point of size* to one of many millions, the result has been a dreadful lack of officers with military experience, discipline, and training. It cannot be otherwise but that confusion, inefficiency, and slowed-down transportation will result in combat areas. It is inevitable that many of the wounded will be a long time reaching the base, and



that first aid is all they will get for some time. Such is the price our fighting men have always paid for unpreparedness.

The laboratories throughout the United States in the Army and Navy are originating and constantly working on relatively nonbreakable substitutes for glass. Much progress is being made. Plastics and resins are being utilized for lenses with some success. They are relatively unbreakable, which is a very great advantage, but they have other physical characteristics that are undesirable. For example, they are soft, and hence scratch easily; they do not retain their shape, and hence the dioptric strength does not remain constant, or the material becomes discolored by brilliant light and is less clear.

It is obvious that a substitute for glass for ophthalmic and other lenses for windshields and windows for airplanes, and so forth, which has not the above-mentioned disqualifications, will be of the utmost value.

Despite our criminally shortsighted preparation for war, which has heretofore been as inevitable as death, I think we are better prepared than in former wars, but relative to the remarkable preparation of our enemies, I doubt it. Vail invites attention to the suggestions of Sir Richard Cruise that 50 percent of the eye injuries could be prevented by some form of eye protection. The officers of the combat services say vision is impaired by such protector devices. The line officer is correct but that is only one of the reasons soldiers go into battle without many of the protections they might, could, or should have. These soldier lads have to carry it all on their backs. Only those of you who have been in battle can realize what that means, fatigue near to exhaustion, hunger, thirst, intense heat or cold, a weariness of soul and body which no civilian can understand, with a battle at the end of it. He throws everything away

he has but his fighting tools, and no officers can stop him nor do they try. Sir Richard was correct but his viewpoint erroneous. Foot soldiers have always so stripped for battle; otherwise their fighting efficiency is much impaired and, of course, that cannot be.

#### AVIATION OPHTHALMOLOGY

Major Weaver<sup>14</sup> in a personal communication states that high velocities, high altitudes, low oxygen tension, even when using an artificial oxygen supply (extreme cold, minus 68°F. at 35,000 feet), and reduced barometric pressure, together with night flying for combat observation and bombing, have created a number of new and basic problems, the most important one perhaps being fatigue. These problems have been studied for years by foreign powers, but in our own country not until very recently have laboratories and other facilities been available for our army to make the studies so urgently needed to solve these complicated and diverse matters. It is obvious that a group of men in many special branches of science are required to study these matters and the facilities of thoroughly equipped laboratories are necessary. In our country no adequate group of scientists or laboratories was available until about the time or shortly after the enemy had attacked and seriously crippled us. We were wasting billions of the people's money in political works administrations but only a trickle for that essential necessity for our national safety—scientific study of war and in preparation for war.

Many studies have been made since the recent facilities have been supplied but there are so very many which have not been made because of lack of time. We know research cannot be carried out hurriedly.

According to Weaver, "the factors peculiar to aviation which influence vision



may be listed as anoxia, decreased barometric pressure, temperature changes, acceleration, fatigue, nutrition, physical fitness, and certain drugs."

As to *anoxia*, it would seem that the direct effect upon the eye is closely related to the effect upon the central nervous system, the cerebrum in particular. Since the visual part of the eye is an integral part of the brain we may assume this to be true. Cerebral function is less effective and slower, depending upon the degree of anoxia, and so is vision. Visual acuity and color vision are lessened; perhaps the latter is obliterated. Night vision becomes less efficient. The visual field is reduced in size. Fatigue of the nervous system and, in consequence, of the whole body ensues.

*Toxic states*, resulting from infections, drugs such as the sulfa drugs, alcohol, and so forth, render the flyer less efficient. The toxins of fatigue, which occur naturally more promptly in those not in "hard" physical condition, also greatly contribute to early lessening of the efficiency of the flyer. No doubt the "poisons" of civilization must contribute to this condition; I refer to tobacco, tea, coffee, and alcohol in excess.

Is it not obvious that the best preventive of eye disabilities for the armed services and in particular the air forces of these services, is a strong body, a strong mind, and a pair of strong eyes for that strong body and mind to see with? Isn't it equally obvious that in order to have this, the physical training of these youths should begin at the beginning of life? When they enter school it should be continued and given equal value with mental training. If this had been done by the schools from the primary grades to the end of high school and by the colleges from their freshman year through the senior year, would we have so many lads disqualified for the air forces because of myopia and undeveloped bodies? I think not. Why did

the schools neglect our youth? I do not know the answer. Do you?

Long-continued anoxia, even of low degree, leads to cortical changes, which though irreversible may be subclinical because of the great number of reserve cells in the cortex; similar changes may be inferred in the eyes, particularly in the ganglion cells. It is stated that the time required for irreversible changes in the cortical cells in acute anoxia is from 5 to 7 minutes.

As of this date, I am not aware of observations or experiments showing the effect of anoxia upon color vision. One must assume it is profound. According to Weaver, pilots have reported their color vision dulled as noted in signal lights after high-altitude flying. The lack of accurate knowledge concerning color vision prevents the acquiring of necessary information by observation and experimentation.

It is unfair to assume that those who have slight color-vision deficiencies may be dangerously low in color perception in the presence of anoxia, even of low degree. We are more aware of the effect upon the motor functions of the eyes—accommodation, the vergences, and the highly associated movements of the eyes—all of these may be disturbed. Minor motor anomalies may become serious major ones. I have observed a number of cases of exophoria due to divergence excess in those who have been flying for several years. They had been carefully examined before being given the responsibility and at intervals since. It has seemed to me that it has been acquired since they began regular flying and spending long hours at moderate airplane altitudes, 8 to 12 thousand feet. The majority of cases I have seen are not due to convergence insufficiency but to divergence excess. Could the anoxia, coupled with long-distance vision in which the divergence is presumably under a strain, have

a bearing on this? It is a fascinating hypothesis. We know, of course, that vertical phorias are less amenable to control than the lateral ones. Exaggeration of these vertical phorias, by anoxia, could disorganize binocular single vision very quickly and very effectually. Our knowledge of the effect of such disturbances upon convergent squint and less perhaps upon divergent squint will enable us to understand this easily.

Quoting from Weaver, who quotes Rickenbacker during the first World War:

"Another of those little precautions which might spell the difference between life and death, was the habit I forced on myself, always to make two complete circles of the landing field before landing at the end of a patrol from 15,000 feet."

He had observed that his landing ability was impaired; this is due to a number of causes, impairment of the depth perception being perhaps the most important. Weaver states,

"Vertical deviations are of the greatest importance in landing since, with such displacement, depth perception which results from fusion and consequent stereopsis is not only lost entirely but if the flyer lands according to the information furnished by the falsely projecting eye, he may land high or fly his ship into the ground. In the air, under combat conditions, similar misinformation under conditions of anoxia may lead to equal danger."

We remember that a latent deviation becomes manifest and exaggerated under anoxia and becomes a complete tropia with diplopia or monocular vision due to suppression of the vision of the deviating eye. Fatigue, profound emotional disturbances, the unusual ocular conditions of flying will all add to the motor weakness.

Anoxia definitely slows dark adaptation. Long-continued subclinical anoxia or the cumulative effects of anoxia have not been exhaustively studied. Cold does the same thing. It has been observed that in

exposure to extreme and long-continued cold the effects upon the nervous system are very similar to those from anoxia and are probably due to anoxia from the slowing of the heart and, hence, of the blood stream. It is thought that this is the cause of the extreme somnolence that overcomes those approaching death from freezing. In anoxia it is probably, Weaver infers, that the synapse is altered in the retina and in the tracts from the visual cortex to the extravisual cortex.

The importance of night vision and combat aviation are stressed by Weaver. He emphasizes, on the one hand, the use of the macular retina and cone vision for daylight and color vision and, on the other hand, peripheral retinal or rod vision. The rods serve a colorless task in daylight and register movement and large objects. At night when dark adaptation has taken place and illumination is by the stars, the rods are the more active. They locate the object of low light intensity. When, however, fixation is shifted to the macula, the image disappears because the cones have a much higher threshold for light than do the rods. "Rods are one thousand times more light sensitive than cones under conditions of dark adaptation," says Weaver.<sup>14</sup> "They do not distinguish color but only degrees of brightness." At present it appears that the complete serial values of cone and rod vision, under dark-adaptation conditions, are not so important in classifying the night vision of an individual as is the calculation of rod-threshold value after a time interval in the dark of 30 minutes. Obviously, in aviation the light threshold of peripheral vision is by far the most important factor.

Rods do not see colored light in their corresponding colors but only as white light of different degrees of brightness.

Consider three lights to be of equal intensity, blue, red, and white. Using "pho-

toptic vision"—that is, "day eyes"—the white or red will appear brightest and they will be recognized as different colors. "But let the individual see these lights from a great distance under conditions of dark adaptation, such as the pilot lights of an enemy plane, the blue light can easily be seen; the white light is 1/10 and the red light is 1/100 of the blue light's brightness." The red light will not be seen at all under such conditions. Obviously, as Major Weaver writes, the blue light is the most dangerous as a blackout light and red the least dangerous. This is a matter of great practical interest to ophthalmologists.

Night vision may be materially retarded by anoxia and a reduction or absence of vitamin A. It must be remarked here that giving vitamins to a normal person does not improve his night vision.

In *changes in barometric and temperature pressure* a great many new and difficult problems have arisen. Because of the cumbersome helmets, oxygen masks, and goggles, vision may be interfered with to a very marked degree. There are a myriad of mechanical failures of the apparatuses to supply oxygen and heat to the pilot in a temperature of minus 68°F., and low barometric pressure at 35,000 to 40,000 feet. All these make efficient seeing difficult and inefficient but can be corrected only by improving the mechanical arrangements necessary for sustaining life at such altitudes.

*Acceleration* (speed), particularly angular acceleration—that is, as encountered in the pullout of a dive—precipitates in some flyers the "gray out" which warns of the imminence of "black out" or unconsciousness. These phenomena are dependent upon habitus and physical fitness of the individual, the length of time the physical forces act; the number of G's (units of gravity). The latter is directly proportional to the velocity of the plane

and inversely to the radius of the executed turn.

"It is not known whether the factors involved are cerebral ischemia with resultant cerebral anoxia alone or whether the differential between the pressure of the cerebral and retinal arteries is of importance" (Weaver<sup>14</sup>).

## FATIGUE

Of all the subjects discussed, none is more important to the pilots than efficiency of vision. The first and most important factor is the pilot himself; how good a man is he? How physically fit is he? Has he any inherent physical or neural weaknesses? We have discussed the most important contributing causes, anoxia, acceleration, and combat; also the mechanical appliances, goggles, masks, and so forth, all reducing efficiency. They fret and worry the pilot and this contributes enormously to fatigue. Goggles with a common glass for both eyes do not so reduce the nasal visual fields nor the binocular field of vision. In such a goggle, removable plastic lenses of different colors may be utilized. Plastic lenses, being fire resistant and non-shatterable, protect the eyes in a crash and also against fire, the latter being particularly important in the "flash" fires of this war. In various naval engagements the number of eyes badly burned from the "flash" fires (the blast from an exploding shell, a gun or bomb, or explosion of gasoline in a confined place) has been considerable. Tremendous heat is generated for a fraction of a second. Also many eyes are injured by swimming in oil-covered seas. This appears to cause a severe conjunctivitis and in some cases mild keratitis. So far as I am aware no permanent injury has resulted from this cause.

The use of heavily tinted glasses is really necessary under certain conditions of flying. Flying above the clouds produces

the most intense glare from below; the sun from above is a different sun from the one we see from the earth, much more powerful and intense. The combination of the two is very trying and very fatiguing even to the strong normal young eyes of pilots and requires protection.

Major Weaver<sup>14</sup> mentions an interesting fact in connection with drugs of the amphetamine type, stating that Axis pilots are believed to be well supplied with such drugs. It appears that the advantages outweigh the disadvantages. One may understand how the nervous system may be whipped up for a temporary exploit. In time of stress, it might be advantageous. It would appear that abuse of such drugs might occur and that their use should be attended with great care. Any drug stimulating the nervous system naturally accelerates vision and the whole visual apparatus temporarily.

It is unnecessary to consider before a gathering of ophthalmologists the minor injuries to the eyes. Their treatment and disposition are the same in civil life except certain modifications in the military service which will suggest themselves to the ophthalmic surgeon.

Burns from heat or caustic agents require care that often cannot be provided in combat and probably for some time afterward. It is useless to think of special solutions; if one has water from his canteen he is fortunate. The crudest possible arrangements may be contemplated and met with where the good sense of the surgeon and the skill in his hands will be about all that he has to work with. It may be that all we have with which to wash the eyes is water from a stream or a water-containing plant. Such plants are often encountered in the tropical jungle—the rattan vine, for example.

As to neutralization of chemical burns, this is practically impossible and in mili-

tary life would probably be utterly so. Prompt removal of excess alkali or acid by copious injection, should fluid be available, is desirable.

My experience in the jungle fighting in Mindanao, Bataan, and other parts of the Far East (which is far no longer) enable me to say that if you have any medical supplies it will be due to your fighting spirit that you obtain them and to your physical vigor if you have them in combat. I mean that you, yourself, personally, may have to carry them on your own back into the fight. Hence, it is idle to talk of having for first aid this favorite prescription, or that favorite irrigant. At the field station, if one is at hand, more adequate first-aid treatment may be had.

Gas burns in military life, when they do occur, are sudden and in great numbers, and only the most casual first aid is possible as a rule. We are familiar with sodium-sulphate solution (0.4 percent) for use in tear gas burns. For mustard-gas burn, use copious irrigation as promptly as may be possible; if available, 1.5-percent solution of sodium bicarbonate, saline, or boric-acid solution. Five-percent sulfathiazol ointment is advocated in cases of severe burns. I have had no experience with this.

Lewisite is probably more destructive than mustard gas. I am not acquainted with its late or latent effects as compared with those of mustard. Copious irrigation and subsequent symptomatic treatment are all that can be given.

We should bear in mind that contusion of the globe may follow explosions, mines, shells, bombs, and so forth, without much obvious damage to the external tissues and be prepared to deal with the many complications and sequelae which arise as a result of such injuries.

It would be well if all, not technically informed, should thoroughly familiarize themselves with local anesthesia for all

ophthalmic operations. General anesthesia may be impossible or difficult to have administered. There are no operations upon the eye or adnexa that cannot be performed without severe pain if the methods of securing anesthesia by infiltration or nerve block are adequately known and followed. This statement applies to civil

life as well as to military life.

It is interesting to remember the War Manual Number 3, written by Colonel Greenwood, Colonel de Schweinitz, and Colonel Walter Parker, which would be perused with profit by any of the doctors going into military service.

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## EMILE JAVAL\*

### AN APPRECIATION

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From the list of subjects in which your committee suggested you might be interested, I have chosen the name of one for whom I have profound admiration. It is that of Emile Javal, known to us as an ophthalmologist, but, to his countrymen he was also a hygienist, a politician, an educationist, and a social reformer. By his death, our profession lost a very distinguished member who, at that time, was known throughout the world as one who had taken an important part in modern ophthalmology.

Javal was born in Paris, May 5, 1839, and, at his death in his native city, had reached his 67th year. Possessing an unusual and active mind, from his boyhood he was attracted by every problem, physical or biologic, that came his way. He had wished that he might enter medicine, but was trained as a mining engineer. He became interested in the case of his small sister who was cross-eyed and amblyopic (strabismus had been a distinctive feature of several members of his family, including his father). For her he conceived the idea that by means of a stereoscope, binocular vision might be developed. The results which she attained from her brother's perseverance during several years reached a degree of development sufficient to convince him of the value of his observation. Impressed by that result he decided to abandon engineering, and forthwith took up medicine. Having his sister's case in the background of his mind, he early began to give his special attention to diseases of the eye. For a pe-

riod he was one of von Graefe's pupils.

With the outbreak of the Franco-Prussian War in 1870, he entered into the service as a military surgeon, and continued therein until the end of the war. He then returned to his chosen field of practice but, having espoused decidedly liberal ideas, he began to interest himself in political affairs. In 1875 he was elected to the General Council of the nation, representing a county district. Later, gaining a seat in the Chamber of Deputies, he became noted both in the Tribune and in committees. All this, however, without interrupting his professional work. M. Zola received much inspiration for certain of his works from Javal's interests and knowledge, and during the Dreyfus trial Javal went to Rennes and exerted himself on the side of the accused.

In the meantime he translated into French, Helmholtz's "Physiological optics"; continuing with energy and ingenuity the study and treatment of strabismus, the result of which he published in 1896, a "Manuel theorique et pratique du strabisme." It may be stated that through Javal chiefly have we learned that the faulty vision of the squinting eye frequently may be improved and that, by dint of compulsory education, through practice with stereoscopes and other educative exercises, the power of fixation may be acquired and true binocular vision established even in long-untried cases. Javal, accordingly, may be counted the patron saint of orthoptics. He warns us, nevertheless, that the time and trouble involved in achieving good results are out of all proportion, sometimes, to their value at the ultimate attainment.

\* Read at the annual dinner of the New York Society for Clinical Ophthalmology, Tuesday, May 25, 1943.

In addition to these particular subjects, he was a persistent advocate of reforms in the hygiene of schools, especially toward the conservation of the sight of children.

My first knowledge of Javal was gained while inquiring about a well-worn instrument, called an "ophthalmometer," which I saw at Wills Hospital while still an undergraduate. It is such an instrument with which Javal's name is more definitely connected than with his extensive work on strabismus. The principle of the ophthalmometer consists in affording means for the measurement of the curvature of the cornea and the lens (a keratometer it really is) by observing the images of special parts reflected from their surfaces. The estimation of such images was not an original discovery by Javal, for, years previously, Young and others had devised instruments for the purpose, and Helmholtz more recently had perfected an instrument which Donders deemed to be "one of the greatest treasures for which we are indebted to his genius." Yet, today, we owe to Javal and Schiötz, his Norwegian collaborator in the laboratory of the Sorbonne, the simplified instrument with which we can rapidly study the cornea's curvature.

Their first perfected instrument was exhibited at the International Medical Congress, held in London, 1881. The ophthalmometer took a place among the approximate tests in the practical working out of ametropia. Its indications are definite and the ease and rapidity with which these may be obtained betokens its usefulness. The results which can be reached with scientific precision and accuracy, in the case of astigmatism in aphakic eyes, assure us of its distinct value. It has positive limitations in usefulness, however, for it does not give the refractive condition as a whole, nor furnish indication as to the existence of myopia or hyperopia; neverthe-

less, while giving with exactness the radii, in all meridians, of curvature of the cornea, it manifests the directions of the principal ones.

The history of the Javal ophthalmometer may be found in a volume, edited by Javal, entitled "*Mémoires d'ophtalmométrie*," containing a number of papers by many writers, European and American, including Theobald and Swan Burnett, who became ardent advocates of the use of the instrument.

We are indebted to Javal for the adoption of the metric system in the dioptric numeration of lenses, and the abandoning of the old inch measures. He suggested also gilded rims for the concave lenses and silver for the convex. He devised the star or fan for the estimation of astigmatism. He urged the increased utilization of cylindric lenses even in low degrees of error.

In 1885, at the end of an election campaign, by a sad irony of fate, in spite of skillful treatment, his right eye was blinded by glaucoma. In the succeeding years he suffered many transitory attacks in his left eye. In 1897, the excitement of the Dreyfus trial at Rennes precipitated the final attack. He was kept more or less under the influence of pilocarpine during 15 years of active work. In 1900 he went to England for treatment, under the direction of Priestley Smith. An iridectomy gave only temporary relief, and, during the succeeding five months, in spite of all efforts, the eye became blind. On his return to Paris, by his own desire, the cervical sympathetic was divided, but with no benefit to his sight.

This terrible affliction did not dampen his spirit. On the contrary, with philosophic fortitude he promptly set himself to study the means by which the lot of those who lost their sight during active adult years might be ameliorated. Javal early found, as did Helen Keller, that



"the greatest curse of the blind is not blindness, but idleness." After three years of experience he issued a little book which he called "Entre aveugles." It has been translated into many languages; the English version bears the title "The blind man's world"; my American edition, published in 1905, "On becoming blind." The author counsels the blind and their friends on such matters as "Replacing sight by other senses"; "Household and professional occupations"; "Marriage"; "Neatness, hygiene, health"; "Dwelling"; "Meals"; "Watches and clocks"; "Walking"; "Tandem tricycle"; "Travelling"; "Reading aloud"; "Handwriting and type-writing, including raised, or embossed Braille"; "Music"; "Games"; "Tobacco"; "Esperanto"; "The sixth sense"; and a chapter on the "Psychology of the blind."

The book is a fine instance of valuable work planned and carried out under a calamity great enough to overwhelm most individuals. In reading between the lines one is impressed by the sincerity of the afflicted gentle soul whose efforts to help others are but expressions of his determination to conquer his own helplessness. Friends returning from visits to France repeatedly told me of their having seen Dr. Javal on his tricycle wheeling through the streets of Paris; and, medical men of their conferences with him.

In 1894 Javal edited and prefaced an edition of the ophthalmologic works of Thomas Young which Tscherning had translated into French, published in Copenhagen.

During these latter years Javal was preparing another important work "Physiologie de la lecture et de l'écriture" which appeared in 1906. It describes the evolution of written and printed characters, including those of stenography, musical notation, and relief-writing for the blind. He discussed the principles on which letters should be

formed to afford the maximum legibility and he indicates how handwriting might be so faulty as to become "an offence to common sense." The first edition was exhausted in three months.

These works show how keen and how purposeful was Javal's interest in many things; "Esperanto," for instance, and "Spelling reform," and, always unceasingly, means for improving the condition of the blind.

Javal was a deeply religious man, maintaining the highest ideals in his daily life. Many honors were granted him; honors that indicate the appreciation of the world for his service to medicine and to ophthalmology. In 1885 he was elected to the "Académie de Médecine," and honorary member of the Ophthalmological Society of the United Kingdom of Great Britain, having been invited to deliver the Bowman Lecture in 1907. His health was such, however, that he could not undertake the journey. Death soon followed from the effects of gastric cancer, January 20, 1907.

My desire to tell of the life and works of Emile Javal rests on a long-held belief that he is preëminently the exemplar for the new-education of the sightless and the guide leading the blind onward in self-dependence. It would be natural for him, and for ourselves to expect him, to offer advice to practicing ophthalmologists, something of the means with which to lighten the misery of their unfortunate patients and others. The little book is packed with suggestions for ways to enable the adult blind to "live with the least possible evil with their infirmity." Children, as we all know, are reported on early, and are sent to schools for their special instructions, and are taught all the arts and maneuvers enabling them to enter life with remarkable independence.

Javal's avowed purpose was to write for the family of the blind, offering to

them helps attainable at the smallest cost, with which they themselves can lighten their burden in living with the blind one. The chief burden of the blind, as he knew and as we, too, know, is their forced dependence on others.

He begs us "to resist" what he calls "the barbaric tendency" to leave our patients with the hope of recovery, whose course toward blindness is certain, that by injections of one or more kinds of drugs, electrical currents, or useless internal medicine, their condition can be relieved. To give consolation by a placebo treatment to an incurable is to prevent him from arranging his life in anticipation of the fatal outcome. It is more humane to prepare them, little by little, for their fate. He, accordingly, wishing that there might be done for others what he would have liked to have had done for himself, sent forth this little book with the hope that it might serve to render easier some ill-fortune like his own and thereby give to himself the special consolation of having helped others.

The appliances and other helps which he recommended, and all that have been devised since his time, can be obtained through the Blind Societies in any city in the country. No person is too old to learn to use them; the struggles of the teachers are concerned almost entirely in enforcing the will of the pupils to accept instruction and to carry on after the lessons have been accomplished.

Out of my great admiration for Javal, my desire has been to make a special appeal to ophthalmologists to consider the future of those whose sight is irrevocably falling into helpless blindness. Just here there occurs to me the knowl-

edge that two ladies, well beyond 60 years of age, suffering from high-grade myopia—one with well-preserved backgrounds—but who has had repeated extravasations—the other with ragged backgrounds and cataractous lenses, each has in the past two years become so skillful in typewriting as to be able to carry on correspondence with their friends and conduct their daily business notes. A gentleman, when forced to reside at a great distance from civilization, took up beekeeping. Later, when I extracted his lenses, so brilliant became his sight that he, at times, regretted that he had had them extracted—so simple and easy had life become, he was no longer his own hero.

For several years I have been one of the Pennsylvania Home Teaching Society for the Blind and have the honor to be the President of the Board which manages the affairs arranged solely for the benefit of the hundreds of adult pupils to whom annually thousands of visits are made by a staff of competent, though entirely blind teachers.

My allusion to these facts arises from the likelihood, and indeed the probability, of a great increase in the number of the blind following the present worldwide cataclysm—both civilian, and through "grim-visaged War."

In the Archives of Ophthalmology for April, 1939, in commemoration of the centenary of Javal's birth, James Leber-son published a sympathetic tribute to the master. In that you will find what I have wished I might have had the time to tell of his personality, to add to the brief, matter-of-fact account I have given.

*317 South Fifteenth Street.*

## ENDOPHTHALMITIS PHACO-ANAPHYLACTICA\*

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*Saint Louis*

It was in 1934 that Burky<sup>1</sup> first reported his ingenious method for the production of experimental endophthalmitis phaco-anaphylactica in rabbits. In his report he also gave a brief but complete summary of the work and ideas on the subject up to that time. There is no need for its repetition here. To the best of our knowledge, his work has not been confirmed in the literature, and hence this paper in confirmation.

Burky<sup>2</sup> had previously noted that rabbits given intracutaneous injections of staphylococcus toxin developed not only an antitoxin for the toxin but also a hypersensitive state to the beef broth in which the toxin was produced. He reasoned that if such a poor antigen as beef broth could be made active by the intermediary action of staphylococcus toxin, then this same toxin might have a similar action on lens substance.

The experiments which he then devised bore out his idea, the results confirming the hypothesis of Verhoeff and Lemoine<sup>3</sup> concerning the allergic nature of endophthalmitis phaco-anaphylactica. He demonstrated that such an allergic state could be attained through the intermediary action of bacterial toxin.

It is not necessary to describe his technique here in detail; those interested should read his original paper.<sup>1</sup> It is our purpose merely to confirm Burky's work, the confirmation being the first step in a series of experiments having to do with the possible relation between endophthalmitis phaco-anaphylactica and sympathetic ophthalmia. DeVeer<sup>4</sup> (1940) wrote

an excellent article on this subject, speculating upon a possible relationship between the two entities and citing several case histories in support of his speculations; no experimental work was done, however.

### EXPERIMENTAL

According to the method of Burky, both a lens extract (of beef eyes) and a lens-broth toxin were prepared, an HA strain of *Staphylococcus* being used for the latter. Seven rabbits were then prepared for intracutaneous injection by depilation with barium sulfide. Two rabbits were given 0.5-c.c. intravenous injections of the lens extract each week. The others received at weekly intervals 0.1 c.c. of lens-broth toxin in one cutaneous area and 0.1 c.c. of lens extract in another cutaneous area. Reactions were recorded by measuring the maximum diameter of erythema, swelling, and necrosis in millimeters.

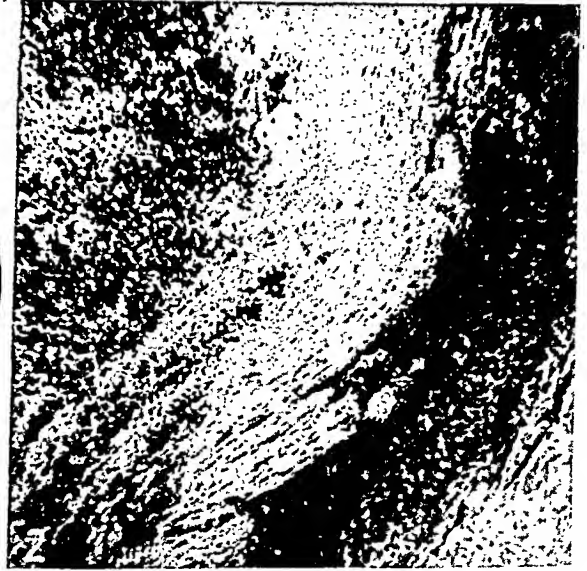
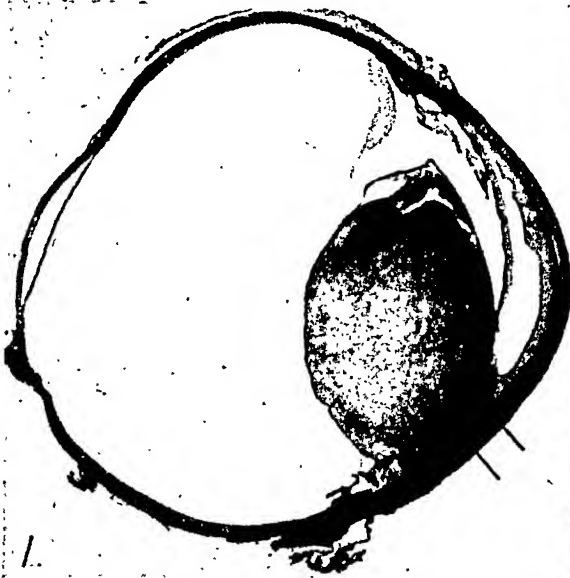
The first injections were followed by erythema and swelling, which appeared in from 24 to 48 hours. It is interesting to note that, in contrast to the observations of Burky, the cutaneous reactions of our group of rabbits seemed to decrease rather than increase with each subsequent injection, yet the final outcome was the same; that is, a clinical and histologic picture of endophthalmitis phaco-anaphylactica. Also in our series, necrosis was absent or minimal. These findings were the same both for the lens extract and the lens-broth toxin. Burky found that the majority of his rabbits attained their maximum sensitivity (cutaneous) following the fourth injection. Because of the lack of any marked skin reaction indicative of a developing cutaneous sensitivity, our

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series was carried to seven injections in an unsuccessful attempt to demonstrate this same cutaneous sensitivity. A small erythematous area measuring from 0.5 to 1.0 cm. would occasionally mark an injection site 24 or 48 hours later. There were numerous occasions on which not even this small skin reaction could be noted.

and remained there when the syringe method was used; another factor was, perhaps, that of internal swelling of the lens material produced by the injected aqueous, forcing apart the lamellae.

The eyes were enucleated at varying times following this experimental trauma. Two eyes had to be removed on the fourth day to prevent their rupture, and one



Figs. 1 and 2 (Scobee and Slaughter). Endophthalmitis phaco-anaphylactica. Fig. 1, Low-power section of entire globe showing reaction of endophthalmitis phaco-anaphylactica. Fig. 2, Higher-power view of section of figure 1 as indicated by lines. The lens substance shows monocytic invasion, and dissolution can be seen at the left. The heavy, dark-staining infiltrate at the right is the surface of the ciliary body. A zone of relatively clear cortex is between the two infiltrative zones.

At the completion of this series of sensitizing injections, the right eye of each of the rabbits was needled with a Ziegler knife-needle, a crucial incision being made in the lens. Two days later, the left eyes were needled according to Burky's method of aspirating aqueous in a hypodermic syringe and then injecting the aqueous thus obtained deep into the center of the crystalline lens. It was noted that although similar clinical and histologic pictures developed in both eyes of each sensitized rabbit, the reaction was definitely more marked in the left eyes (traumatized by Burky's method). This might be expected, since aqueous was brought into contact with lens material

ruptured during its removal. The same thing happened in Burky's series. The remaining eyes were enucleated on the tenth day, when clinically all showed an endophthalmitic reaction of varying degrees of severity. There was suspicion of secondary infection on clinical grounds in two of the eyes, and this was confirmed histologically by the predominantly polymorphonuclear character of the infiltrate in them. Eyes from the control rabbit showed only a normal response to the trauma of needling. Rabbits 9 and 11 were those which received the intravenous injections of lens extract and they showed practically no reaction other than that due to the trauma of the needling.

Dr. T. E. Sanders was kind enough to study the group of eyes pathologically, and his report was as follows:

"The reactions in these eyes varied from very mild to extremely severe. In all cases, the reaction was chiefly localized in the anterior segment. In the mild cases, there was no particular inflammatory reaction. There was a wound of the an-

terior lens capsule with varying degrees of degenerative cataractous formation. This process usually extended around to the posterior capsule. There were varying degrees of attempts at healing in the anterior capsular wounds by a fibroblastic reaction. Inside the posterior capsule, a peculiar cellular ingrowth formed almost a posterior epithelial layer; this apparently arose from the region of the equator. The posterior subcapsular cells were present in the eyes of rabbits receiving the intravenous injections as well as those which had the intracutaneous ones. There

was a homogeneous eosinophilic substance in the anterior chamber.

"The eyes showed a chronic inflammatory reaction, chiefly in the area of the lens trauma. This consisted of a heavy infiltration of chronic inflammatory cells in the area of liquefied lens and extended out somewhat into the more intact lens substance. There were relatively dense

TABLE 1  
SUMMARY OF OCULAR REACTIONS

Rabbit No.	Injections before Needling	Cutaneous Sensitivity to Lens Extract at Needling	Ocular Reactions		Day of Enucleation
			Clinical	Histological	
Group I. Lens-broth toxin and lens extract intracutaneous injections					
1	7	Waning	Positive	Positive	10th
2	7	Positive	Positive	Positive	10th
3	7	Positive	Doubtful	Doubtful	10th
5	7	Waning	Positive	Positive O.S. Secondary infect. in O.D.	10th
6	7	Waning	Positive	Positive	4th
7	7	Positive	Positive	Positive O.D. Secondary infect. in O.S.	10th
8	7	Waning	Positive	Positive	4th
Group II. Lens extract injected intravenously					
9	7	Negative	Trauma	Negative	10th
11	7	Negative	Trauma	Negative	10th
Group III. Normal control rabbit					
10	None	None	Trauma	Negative O.S. Secondary infect. in O.D.	10th

terior lens capsule with varying degrees of degenerative cataractous formation. This process usually extended around to the posterior capsule. There were varying degrees of attempts at healing in the anterior capsular wounds by a fibroblastic reaction. Inside the posterior capsule, a peculiar cellular ingrowth formed almost a posterior epithelial layer; this apparently arose from the region of the equator. The posterior subcapsular cells were present in the eyes of rabbits receiving the intravenous injections as well as those which had the intracutaneous ones. There

posterior synechiae but relatively little infiltration into the iris tissue in the milder cases. The infiltrate was predominantly monocyctic, with a few lymphocytes and polymorphonuclear cells. There was no evidence of necrosis; varying degrees of vasodilation of the iris vessels were noted. A moderate number of monocytes were seen on the endothelium of the cornea, on the surface of the ciliary body, and on the nerve head. This distribution was essentially that of chronic endophthalmitis.

"In the more severely involved eyes, a marked keratitis was present near the

limbus which included all the layers of the cornea and seemed to have no relation to the site of corneal penetration from the needling. On one side, this keratitic area was so thin that early ciliary staphylomata were seen. Over the surface of the retina in the more severely inflamed eyes could be seen monocytic cells. In the secondarily infected eyes, the polymorphonuclear cell was quite prominent in the infiltrate.

"In the group of eyes not secondarily infected, the pathologic picture was one of endophthalmitis, with predominantly a monocytic infiltration, hence a 'chronic endophthalmitis.'"

#### COMMENT

Friedenwald<sup>5</sup> has stated that the character of the cellular infiltrate is of some value in distinguishing the findings in the allergic animals from those in accidentally infected control animals. In the latter, the cells are predominantly polymorphonu-

clear, whereas in the allergic animals, they are predominantly monocytic.

#### SUMMARY

Herewith is presented confirmation of Burky's work of 1934; namely, that cutaneous sensitivity to lens substance in rabbits can be induced by repeated and coincident injections of staphylococcus toxin and lens substance. When the eyes of such sensitive rabbits are needled, a clinical and histologic picture develops that resembles endophthalmitis phaco-anaphylactica in man. Our series did not show the cutaneous sensitivity which Burky mentioned, yet end results were the same. We report this confirmation of Burky's work as the first step in a series of experiments having to do with endophthalmitis phaco-anaphylactica and sympathetic ophthalmia.

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# VISUAL ACUITY AT LOW BRIGHTNESS-LEVELS\*

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*Cleveland*

Visual acuity, or the ability to distinguish fine detail, is often of little importance at very low brightness-levels. Contrast sensitivity, or the ability to distinguish small differences in brightness, is commonly of great importance at low brightness-levels such as are encountered outdoors at night. For example, visual acuity has been greatly overemphasized as compared to contrast sensitivity in the testing of automobile drivers for seeing at night. Also there are many problems of seeing in war activities which involve concealment, dark adaptation, and very low brightness-levels at night under moonlight, starlight, and even dark, overcast skies. Lookouts on ships, pilots and observers in airplanes, and drivers of trucks might well be tested for contrast sensitivity. Researches by the authors have revealed a wide diversity in this function even among subjects who have the same visual-acuity or visual-efficiency ratings by the usual methods.<sup>1</sup>

On the other hand, there are some activities in which it is necessary to distinguish fine details under the least amount of light, or lowest brightness, that is practicable. Scales of instruments, maps, charts, and other details must be read with accuracy and as easily as possible under blackout or dimout conditions. In various researches<sup>2</sup> in connection with problems of seeing in wartime, the authors have had to study the effects of illuminants of various spectral characters upon visual acuity. Subjects vary greatly in their ability to see at low brightness-levels, but the data presented herewith were obtained by subjects who appear

to be fairly representative. However, the quantitative results are less important than the decisive differences among illuminants. For this reason the results are presented in diagrams rather than in tables.

In figure 1 are shown typical results obtained with the A.M.A. test chart for seven different illuminants representing a wide range in spectral character. Under each illuminant the subjects were adapted for 30 minutes at approximately the brightness-level at which the largest letters could be distinguished at the test distance of 20 feet. The chart was located in the center of a circular, white field which subtended an angle of 20 degrees. This surrounding field and the test chart were illuminated by the same illuminant. After determining the test line which could barely be read, the brightness of the white background of the test chart was determined by someone other than the subject. Then the background brightness was increased and after adaptation for a standard length of time, about five minutes, the subjects again determined the test line which could barely be read. This procedure was continued for all the lines of the test chart. In all cases foveal vision was used, although in some cases apparently a slightly high visual acuity was obtainable by slightly averted vision.

On figure 1 the illuminants designated by the letter *F* are regular fluorescent lamps. The tungsten-filament lamp was a regular 150-watt lamp and the photographic red lamp was a 40-watt tungsten filament in a red-glass bulb.

It is obvious that as the illuminants progress in integral color from blue to red, there is a progressive decrease in the

\* From Lighting Research Laboratory, General Electric Company.



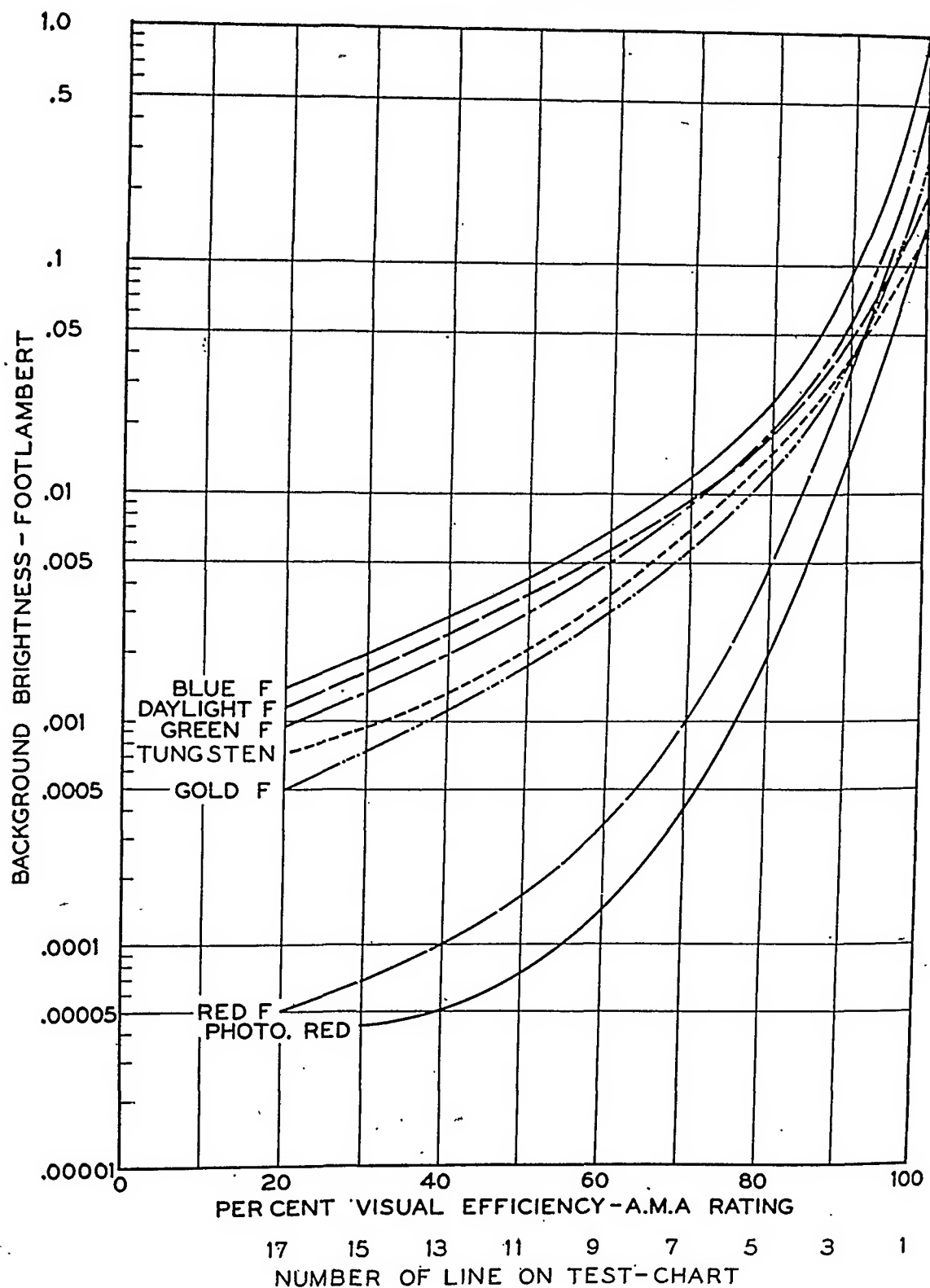


Fig. 1 (Luckiesh and Taylor). Minimum brightnesses obtained with different colored fluorescent (F) lamps, a regular 150-watt tungsten-filament lamp, and a photographic red lamp, at which various lines of letters of the A.M.A. test chart can barely be read.

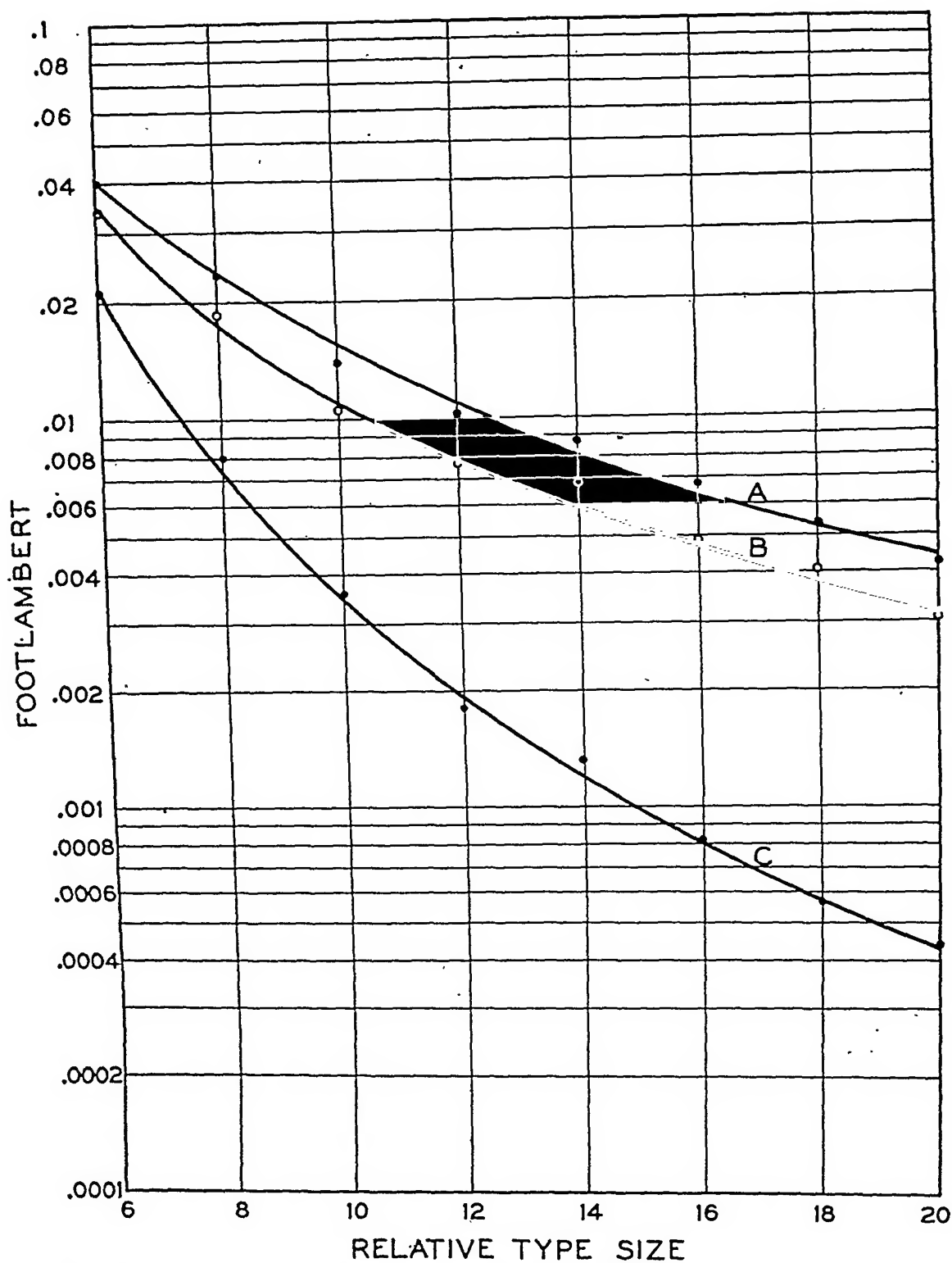


Fig. 2 (Luckiesh and Taylor). Background brightness required for slightly above threshold "readability" of type sizes with (A) tungsten-filament lamp at 105 volts (color-temperature approximately 3,050 degrees K), (B) the same lamp at 40 volts, and (C) the same lamp at 105 volts with Corning HR Signal Red no. 243 filter.

minimum brightness of the background of the test chart at which a given test line can be read. In other words, red light is more effective for a given brightness than the other illuminants. This is a very important matter in many wartime activities where it is necessary to see details with a minimum of brightness.

These data afford a basis for many recommendations. For example, suppose letters, numbers, or other details subtend a visual angle of 20 minutes, corresponding to line 9 on the A.M.A. test chart. The minimum background brightness for such details of maximal contrast (black on a white background) should be about 0.0035 footlambert for tungsten-filament light and about 0.00014 footlambert for red light from a photographic red lamp. This is an enormous difference, for the former brightness is 25 times the latter. Such great differences are of much practical value where concealment, visibility, and the maintaining of a high state of dark adaptation are involved. Of course, to insure certainty of seeing, somewhat higher brightness values should be used.

For those used to thinking in terms of foot-candles or in measuring foot-candles, a definition of the foot-lambert may be helpful. If a perfectly diffusing white surface had a reflection-factor of 100 percent, a foot-candle of illumination produces a foot-lambert of brightness. The white surfaces used reflected about 83 percent of the incident light and therefore had a brightness of 0.83 foot-lambert for each foot-candle of illumination. Therefore, if the foot-lambert values are multiplied by a factor of 1.2, they are converted into approximate foot-candle values.<sup>1</sup>

In figure 2 are shown the results obtained for three illuminants for reading-matter printed with black ink on white

paper. The type sizes ranged approximately from 6-point to 20-point. Curve A is a plot of results obtained for a 115-volt tungsten-filament lamp operated at 105 volts, the color-temperature of the light being 3,050 degrees K. Curve B is for the same lamp operating at 40 volts. Curve C is for a fairly saturated red light.

In figure 2 are shown the background brightnesses for the three illuminants which are respectively necessary in order to read with certainty type of a given size when printed with black ink on white paper. Here again the great advantage of red light is revealed; that is, when details are to be distinguished with a minimum brightness.

In obtaining the data plotted in figure 2, the subject was seated at a table and the reading matter was inclined at approximately 45 degrees. The light was confined to the reading matter by means of a projector and iris diaphragm. The subjects were adapted for 30 minutes to the brightness of the reading matter, the brightness being just sufficient so that the printed matter was just below the threshold of "readability" of the largest type. After adaptation the brightness necessary for reading without uncertainty was determined. Then the next smaller type was placed in position. After a standard rest period the procedure was repeated.

The work of the authors has shown in other ways<sup>2</sup> the great advantage of red light in a variety of problems of seeing in wartime—blackouts, dimouts, instrument dials, charts, orders—where concealment is vital<sup>3</sup> and where dark adaptation must be maintained. The results have many other applications in indicating the visual size of details necessary if they are to be distinguished under very low brightness-levels.

*Nela Park.*

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## ORTHOPTICS FOR THE INFANT SQUINTER, ONE TO FOUR YEARS OLD\*

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*Milwaukee, Wisconsin*

I have been asked to take up the various aspects of our present orthoptic treatment of the infant squinter at the Milwaukee Children's Hospital. However, orthoptic treatment cannot possibly be divorced from ophthalmologic treatment, especially in the infant. Therefore, I shall discuss the ophthalmologic treatment of strabismus in children under four. I only hope that this will not seem too presumptuous on the part of an orthoptic technician. Any opinions expressed on points other than those applying strictly to orthoptics are, of course, the opinions of the ophthalmologists on the Hospital staff.

At the Milwaukee Children's Hospital, an immediate examination, even at six months of age, is considered advisable for several reasons: (1) There are the occasional cases of +8 diopters or more of hyperopia. (2) There are the many cases of pseudostrabismus due to a wide epicanthus, in which the ophthalmologist can assure the parents that, although there is a definite illusion of strabismus, none is actually present. (3) There are the cases in which a true strabismus is found,

due to some organic anomaly or disease.

In all cases of squint that show high refractive errors under a 0.5 percent atropine cycloplegia, glasses are routinely prescribed. In this regard, it is always wise to keep in mind that even a baby will wear glasses if he truly needs them. However, nothing in the world will make a baby keep them on if he does not need them.

When the refraction has been done, the ophthalmologist generally turns the infant squinter over to the orthoptic technician with the familiar words, "Would you like to *try* to get a vision on this child?" With the average child of two to four years of age, a vision usually can be obtained, if not by one method or on that day, by another method, perhaps, or on another day. The illiterate E or "piggy" game as we call it, the Kindergarten chart, the Berens chart, the Landolt broken-ring test, or graded blocks can be used. I am told that the Bailey visual-acuity test is often helpful with a child who has difficulty in understanding what is expected on some of the other tests. In this test, the child is asked to pick from a tray at his side miniature models which match the object-pictures on the chart. Of course, making a game out of any method

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will get results much quicker than expecting the child to sit up and pay attention to a chart on the wall, which many times will probably look like a lot of Greek hieroglyphics. In any child of this age, obtaining a satisfactory visual finding is a challenge and, as it constitutes the first introduction to the little patient, it requires all the resourcefulness at one's command.

When this has been done, the little squinter is generally turned over to the orthoptic technician for a diagnostic series of five or six visits. In the event that a visual acuity has not been obtained, the fixating eye, in a case of monocular squint, or the preferred eye, in an alternating squint, is always easily determined, except in a few cases of alternating squint in which there is no marked preference of either eye. At this time, the parent is instructed as to the form of constant occlusion to be used following the diagnostic series, if it is known that occlusion is indicated. In very simple language the parent is told that occlusion must be used in the better or fixating eye in order to prevent an amblyopia ex anopsia from developing or to improve the vision in an eye already amblyopic. When occlusion is later begun, we usually, in the beginning, use complete occlusion—a patch over the eye if no glasses are being worn or a Stark occluder attached to the glasses if the latter have been found necessary. Both are cut out of waterproof adhesive tape and shaped to the individual face or pair of glasses. When the vision is found to be 20/70 or better, a less complete, but still constant form of occlusion may be substituted by pasting an opaque paper or gummed, translucent mending tape to the lens of the better eye. The possibility of the child's peeking then must be carefully watched. If the complete occlusion on the face of the child who needs no glasses is found too harsh a treatment to be continued indefinitely, a pair of plano

lenses may be prescribed for the duration. Of course, there is always a question as to whether or not the child will keep these on. Other forms of occlusion can then be easily devised by the ingenious parent, such as a soft wide bandeau or a net bonnet, with the patch attached.

Not only is this monocular occlusion considered important for the prevention or improvement of amblyopia but also for the prevention of secondary contractures of muscles, by giving the patient a sufficient amount of monocular exercise. In the case of alternating squinters, an alternate occlusion of first one eye and then the other is usually suggested in order to prevent the development of an abnormal retinal correspondence. When binocular vision is found to be possible, a fogging of the lens of the stronger eye is sometimes suggested. This fogging of the lens may be accomplished in numerous ways, such as by the use of Scotch cellulose tape, a stippling of colorless nail polish, a clip-on smoked glass, or a red kodaloid filter. All of these forms of partial occlusion are of course advised only for infant squinters who have a normal retinal correspondence of long standing.

When the vision, fixation, and the necessity of occlusion have been determined, at least an estimate of the angle of squint is made. At three to four years of age this is usually possible for distance and near vision with the use of a cover test; then, at the same time, monocular and binocular rotations are generally attempted. With a baby under three it is possible only to estimate the angle approximately by the Hirschberg method and to determine a marked paresis. To be sure, any testing attempted in the beginning must be in the nature of a game and in the spirit of play.

On the second visit, a near point of convergence with a colored pinhead or a light is easily elicited, and monocular and binocular rotations again attempted to

ascertain any limitation of motion or overshooting in any direction of gaze. The angle of deviation in the primary position for distance and near is again checked.

The next step is to evaluate the amount of binocular vision the child has in his everyday life. Here we are forced to digress from the routine testing and find out, before going further, if the child knows colors and can count. Needless to say, the Worth dot test, which is the simplest method of estimating the patient's binocular vision, is possible only on a child of three or older. But since it is basically a subjective test, we must determine how much we are going to be able to rely on the child's answers before attempting any actual testing. There are many children who will recognize red and possibly green in a familiar article and yet not be able to recognize it in the Worth four-dot test. We find it helpful to practice naming the colors with colored blocks, marbles, crayons, or even gum candies, before showing any colored lights, as we then know immediately if the colors can be recognized and named correctly. We also find it helpful to practice counting before doing any actual testing. To be sure, this all takes valuable time, but it is always time saved in the end.

On the second or third visit we usually attempt to obtain the measurement of squint and the kind of retinal correspondence on the major amblyoscope. Needless to say, this is not always possible in the case of a child under three years. With such fascinating targets as the lion and the cage, the butterfly and the net, the spider and web, or the bird and cage, we let the child show us where he puts them together, and then quickly flash to determine if the simultaneous macular perception is at his objective angle. If we stimulate the child, in the spirit of fun, to show us how good he is, we can usually determine, in repeated attempts, if he is

actually telling us what he sees or merely attempting to please. In the beginning, we generally find the child eager enough, and yet not too much aware of what he is supposed to see, to obtain the correct answers without much checking on our part. Of course, our flashing to determine the type of correspondence must be quick, as the child's concentration at this age is always poor, despite his eagerness and interest. No findings can be relied upon at this time unless they are corroborated on repeated attempts.

All of our tests are repeated on successive visits until we feel that we are able to give an accurate report of our findings of the visual acuity, fixation, degree of angle, type of correspondence, and measurement of fusion and stereopsis. Even the latter measurement is quite possible if the child's correspondence is normal and his fusion is good. In this event, it is possible that some fusion training at periodic visits may be prescribed to stabilize the present fusion and perhaps acquire some amplitude. However, this is rarely the case, for the average infant squinter at the Milwaukee Children's Hospital is usually advised, after the diagnostic series, to return only for bimonthly check-up visits until he has reached an age at which he can accept concentrated orthoptic treatments. Any actual training given at this time is mainly to help the child to become accustomed to the clinic and the technicians and to determine the type of occlusion, if the latter has been found necessary. On these visits, when the vision, fixation, angle of deviation, and fusion on the major amblyoscope have been checked, there is often time to include numerous other orthoptic activities such as amblyopic exercises or, if the correspondence is normal, cheirosopic work with mosaic patterns, blocks, or small models. Then, when the mother has become familiar with the many monocular

exercises for the infant squinter, she may be given work to supervise at home. These exercises may include coloring outlined pictures, tracing stencils, fitting picture-puzzle or construction blocks, stringing beads, cutting out pictures of all kinds such as paper dolls, or sewing dotted picture-cards. The last two activities of course require dull-pointed scissors with a rounded top and needles with ferruled ends. All of these exercises should be supervised to a certain extent but still allowed to remain play activities of the child.

It must be admitted that all of us are tempted constantly to try active treatment on these little squinters, who are always ready for our games, but we all know that usually even the attempt is a mistake.

These infant bodies and minds are quite naturally not capable of anything but play in a very active form, and these baby eyes cannot be taught to work together in any form of play. The awakening of latent fusion requires much intense concentration, which is often a real task for the adult. To attempt such teaching with a child under four is to take the chance of creating a distaste in the infant's mind for all orthoptic exercises—a distaste that will always be remembered. Before taking such a chance, in any case, should we not ask ourselves if it is really worthwhile and will it not be better to let the infant wait for straight eyes until he is ready to coöperate without endangering his body and mind?

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# THE USE OF PRISMS IN ORTHOPTICS\*

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I am always impressed by those who categorically can enumerate the pros and cons of a given method or procedure in orthoptics; since to me any orthoptic instrument, or method of measurement or training, must be adapted to the specific case. The goal, however, is always the same; namely, the reëducation of a disturbed visio-motor-fusion mechanism. Every patient who comes to me I look upon as an individual with a distinct problem in the use of binocular vision, and my aim is to help that individual to solve his problem, which means to teach him how to attain normal and comfortable binocular vision; or, in some cases, to attain parallelism of the visual axes if possible. I never treat or train just eyes. I always train a person. With this point of view my methods of training are very flexible and adjusted to each particular individual. Not that I do not have some general or fundamental methods and tools. I do, but I may vary them, or use them in various combinations, according to the specific problem.

In each and every case I ask myself, first of all, which method or combination of methods will bring my patient most quickly to his goal; and, of course, as each personality differs the methods of approach must vary accordingly. Since I never train a squint or a phoria or a convergence insufficiency or a divergence excess, but rather, a person with a visual problem who is to be reëducated to achieve normal binocular vision, the methods of

training must always be consistent with existing laws of pedagogy. Thus the essential thing is to study each patient, to analyze the problem as it applies to him, and then to devise the system of procedures most likely to attain good results for that individual. With this point of view the methods of training may become as variable as are subjects or patients, and what may bring results in one case may give little success in another.

Thus when I was asked to prepare a paper on the use of prisms in orthoptics my first reaction was: Why not cover the whole subject of orthoptics, since prisms are used in one way or another throughout most of the field? However, this paper presents an attempt at systematizing the use of prisms and at categorizing some situations in orthoptics in which prisms are used to particular advantage. In order to do so, it is essential, perhaps, to divide the subject into: (1) the use of prisms for making diagnosis and measurements; and (2), the use of prisms for training and treatment, when these are continuously worn by the patient.

*Prisms in measurements.* For diagnosing and measuring muscle anomalies prisms have become one of our primary tools. An ocular-muscle examination without the use of prisms is hardly conceivable. The cover test is the quickest and one of the most accurate of all tests with which to measure deviations, and it should be in continuous use for every case and at almost every visit. The cover test not only gives accurate and quantitative measurements, but it also furnishes a quick check on the results obtained by other tests, and a quick review of a given case preliminary to each training period. The

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cover test, carried out with the aid of either loose hand prisms or any standard prism bar or rotary prism, is the one single tool which may be considered essential for the routine examination. The test should be carried out in the primary and the six cardinal positions.

Again prisms are used in the Maddox rod test in which that amount of prism is found which gives the patient superposition of the light and Maddox streak. The numerical reading on the prism is the quantitative measure of the existing deviation, expressed in terms of prism diopters. This may be eso-, exo-, or hyperphoric; or it may be eso-, exo-, or hypertropic.

A similar test for which prisms are necessary is the diplopia test, which may be used with a red and green light or the letters "ONE." In this test, as in all others in which a deviation is measured, prisms base out are used to bring about convergence until the two images coincide, whereas in cases of divergence, prisms base in are used. These tests are particularly well adapted for testing hyperphorias, when the prisms must be placed either base down or up, depending on the case. The numerical reading of that strength of prism which gives superposition or alignment of the two images denotes the degree of the deviation; provided correspondence is normal. If fusion of the two images occurs at the expense of a false correspondence, there will be movement of the eye when covered. If the two maculas are used there will be no movement. Since this paper deals with the use of prisms as tools in orthoptics and the procedure in making a particular test is described only by way of exemplifying the use of prisms, normal correspondence should always be assumed. It must be borne in mind that abnormal correspondence often changes the procedure or, at any rate, the evaluation of the findings.

Finally, prisms are used to measure ductions. Prisms of increasing strength, either base out or base in, are placed before the patient's eyes while he is observing a small light either at 20 feet or at the reading distance. The degree of prism that induces diplopia represents the duction strength; base out measures adduction and base in abduction, base up infraduction and base down supraduction.

In cases of very high deviations the use of additional prisms may sometimes be necessary in some of the amblyoscopes and the rotoscope, but the measurements obtained in this way are usually not very reliable, because it becomes difficult to fixate with both eyes owing to the mode of construction of the instrument.

*Prisms for training* may be used in various ways. They become a useful tool when employed in loose-prism exercises or they may be used in connection with some instrument. If the angle of squint is over 10 degrees of convergence or divergence, prisms are frequently helpful in such instruments as the myoscope, cheiroscope, and the stereoscope. For example, in using the myoscope, the patient may be given red and green spectacles and then be made to try to fuse the two colored images into one. If the angle of squint is so large that the eyes cannot fuse these images, prisms are placed in the lens holders. These prisms must be strong enough so that the images come together within the range of fusion. When fusion amplitude increases, the prisms may be made weaker.

When the cheiroscope is used, prisms up to the strength of the squint must be placed over the lenses. The child should never be allowed to work without prisms of the proper strength; otherwise he will not be able to fuse, and will only practice alternating fixation.

Variable prisms are also useful in connection with the stereoscope, which aids in

developing amplitude of fusion; and to give abduction and adduction exercises from home training. However, before any of these instruments are used care must be taken that the patient does not suppress or alternate, and especially that normal correspondence has been well established.

In cases of squint prism exercises with loose prisms are of doubtful value. Perhaps with very intelligent and coöperative patients loose prism exercises may be prescribed for home exercises; especially in postoperative cases in which only small amounts of squint remain and in which fusion and good fusion amplitude were well developed before the operation. In this case the prism should be used base out for convergent squint, and base in for divergent squint, the strength being such as to allow the patient to fuse the two images. The prism should be held in front of one eye, and the strength gradually decreased. A prism bar of graduated prisms is useful for this type of exercise, and the training should be done at various distances from the eyes.

Even if exercises with loose prisms are of doubtful value in cases of large deviations, they are most useful in dealing with phorias, especially exophorias. It is essential that the kind of phoria be carefully diagnosed and the individual's ability to cope with that phoria. This necessitates careful measurements of the phoria and the ductions, and for these measurements prisms and a Maddox rod may be employed to great advantage. The measurements are made in the manner aforedescribed. The maximum strength of prism which the patient can overcome is the measure of his duction power. According to Dr. Berens, the normal ratio of abduction to adduction is considered to be one to three. But it is not only important to ascertain the ratio and the breaking point and that of recovery, but also to consider the relationship of the size of the duction

to that of the phoria. What is frequently considered a fair average of adduction power for orthophoric eyes may be completely insufficient when a phoria is present, and by increasing the adduction reserve comfortable vision may be achieved.

For esophoria and abduction weakness prism exercises alone are frequently not very effective. However, in making the attempt, prisms base in are placed before each eye and their strength gradually increased until the maximum strength is reached. Better results will be obtained in prism training with stereoscopic exercises on one of the stereoscopes, or the rotoscope, or one of the major amblyoscopes. When the ordinary stereoscope is used it must be equipped with spring clips for the prisms. These may be increased one or two diopters at a time. This exercise is of benefit in cases wherein the phoria is small and there exists a weak abduction. When there is a fair sized esophoria that is greater for near than for distance, and greater without than with the correction (if this is hyperopic), good results may be obtained with prism and stereoptic exercises after the physician has prescribed full correction. Still better results are obtained if the patient uses some homatropine at night. This last procedure usually helps if the phoria is due to accommodative spasms.

But it is in cases of exophoria and convergence insufficiency that prism exercises may be used with best results. In this exercise one increases the ability to converge by placing the prisms base in in increasing strength. The patient begins with prisms of moderate strength, small enough so that he is well able to overcome them. The prism strength is gradually increased to a maximum degree. The exercise should be performed daily for 10 to 15 minutes. In many cases the patient will learn to overcome the effect of from 50 to 80 prism diopters. Of course fre-

quently these exercises should be supplemented by exercises on one of the major amblyoscopes, the rotoscope, or other major training instruments. These directions are not meant to imply that the exercises described are necessarily the best, nor that they should always be used, but merely indicate the various possibilities of using prisms for orthoptic training. Prism exercises frequently have no effect on the exophoria. However, since they increase the convergence and adduction power and reserve, they increase the individual's ability to cope with his phoria so that he becomes able to read and do other near work with greater comfort.

In order to determine the proper treatment for a given condition, a careful analysis of a patient's muscle imbalance must be made. One should distinguish between different types of exophorias. There is the accommodative type that is found in myopia, and essential exophoria that is apparently unrelated to refractive errors. The latter normally occurs in patients with hyperopia, and quite often the refractive error is very small. Here an insufficient convergence is present or one that is weak. Exophoria is present in presbyopic eyes, in which the accommodation becomes less as the lens becomes sclerosed. Furthermore, the use of bifocals diminishes the response required from the ciliary muscles, which diminution is followed by a corresponding relaxation of convergence. The choice of the treatment should be determined by all these factors, and after the physician has ascertained the refraction and has cleared up any problems of general health. If exercises are prescribed, loose prisms or prisms in connection with some training instrument may be used, but these should not be considered the most satisfactory methods.

In cases of vertical deviations prism training is not so satisfactory, perhaps because the average vertical muscle balance

is stable, varying but little up or down. Three or four degrees is about the limit of one's supraduction or infraduction ability. Since the flexibility in vertical balance is so slight, training with prisms will accomplish but little. However, occasionally a patient is found who benefits from exercises with vertical prisms, carried out on the rotoscope or some other training instrument. Two cases in particular may be cited. In the one there was a right hyperphoria of four prism diopters. Incorporated in her glasses the patient wore prisms that corrected the hyperphoria. When wearing those glasses she had frequent diplopia and headaches. However, after receiving fusion and duction exercises on the rotoscope, during which time the strength of the correcting prisms was gradually decreased at each session, she was able to dispense with the prisms except for near work, and diplopia occurred only when she was tired.

The other patient, a dental student with an old paralysis, gradually decreased a varying left hypertropia of 8 to 13 prism diopters to a constant hyperphoria of 3 diopters. He took exercises for more than six months, and now is wearing in his correction 2 prism diopters base down before the left eye and 1 prism diopter base up before the right eye. Of course it may be suggested that his hypertropia decreased because of a gradual and natural disappearance of the paralysis. This may be true, but this condition existed for over five years previous to the treatment. Surgery had been advised but the patient preferred to try the exercises first.

*Prisms for constant wear.* Some authorities have advocated the use of prisms for squint. The principle is to place before the eyes a prism of such strength that rays of light entering the eyes are diverted so that diplopia is avoided, or, theoretically, so that the rays fall on the maculas and fusion is forced even though

convergence is present. These prisms are worn in addition to the ordinary glasses, usually in the form of slip-overs. The theory is that the prisms produce a desire to fuse and as fusion develops more and more strength of the prisms is continually decreased until the patient can fuse with the eyes in the primary position.

There are several arguments against such a use of prisms in cases of convergent squint. First, according to the laws of learning, we cannot assume that a patient would learn fusion merely by the presence of prisms which divert the rays of light on the two maculas. If fusion could take place so easily many would probably have never developed a squint in the first place. Furthermore, if abnormal correspondence were present, that visual habit would be more recent and stronger than macular vision. According to the laws of learning we may assume that the eyes would tend to respond in the way most strongly fixed. That this actually happens is clear when we consider how difficult it sometimes is to break up abnormal correspondence. Also in cases where surgery was performed in the absence of orthoptic training either before or after the operation, the eyes frequently revert to the old position. Learning to see binocularly follows the same laws as any other type of learning, and in all learning formal practice is necessary. Psychologists have demonstrated many times that accidental learning is poor. According to this we may well doubt that the mere providing of the correct stimulus—namely, light diverted onto the maculas of both eyes—will be able to establish the correct habit. It requires active and controlled practice. There must be conscious practice in using the maculas together. Another argument that may be presented against the constant wear of prisms is that such prisms usually induce extreme discomfort. If the deviation is great the

weight of such glasses is considerable. Also dispersion of light frequently causes asthenopia and other symptoms of discomfort. Furthermore, it is important that the patient look through the optical center of his glasses, and when prisms are used the prismatic effect may easily displace that center when the glasses are not exactly centered, or when careless handling bends the frames.

Some ophthalmologists seem to prescribe prisms for constant wear for all types of phorias, particularly in exophorias and convergence insufficiency. In these cases prisms base in are ground into the lenses of the patient's glasses, and may be given to any patient, but are prescribed particularly for patients over 60 years of age. One doctor of my acquaintance prescribes as though by a fixed rule, two diopters of base in, or one diopter in each lens, in every reading segment of two and a half or more diopters.

The viewpoint adopted in this paper is that the most important muscle deviations requiring prism correction in the glasses are those in the vertical direction. A small hyperphoria of not more than two prism diopters may give an individual many distressing symptoms, and the writer has found that even when such a hyperphoria is accompanied by considerable eso- or exophoria it is frequently the hyperphoria that is the cause of the symptoms. Even with very small hyperphorias the symptoms may be great and may be the cause of defective binocular vision. Tilting of the head toward the shoulder on the side of the hyperphoria is often observed, and this phenomenon usually indicates a vertical deviation which should be corrected.

A tendency toward vertical hyperphoria is also frequent in connection with lateral squint. This vertical deviation seems to interfere with fusion, causing the eyes to alternate as soon as the two images approach the maculas. Because these images

are not vertically aligned fusion becomes very difficult, and if a tendency toward abnormal correspondence is added to this situation, superposition of the two images becomes almost impossible. A correction of the vertical deviation may in such cases mean the difference between success or failure in teaching binocular vision and normal correspondence. The development of adduction in convergence insufficiency may also be speeded up greatly if any complicating hyperphoria is first corrected.

However, the advisability of prescribing prisms for constant wear seems to be debated by several authorities on motor anomalies. Alexander Duane<sup>1</sup> stated that prisms when employed for constant wear are sometimes serviceable in anomalies of the individual muscles, and particularly in vertical deviations, but they may cause mischief in convergence insufficiency or convergence excess or in divergence insufficiency, by further dissociating the very functions which are to be corrected. He warns us that prisms for constant wear are merely crutches and as such should be used only temporarily. The object is to improve the binocular visual function and to integrate the eyes in such a way as to achieve good fusion and ductions and to secure comfortable binocular vision.

William Thornwall Davis<sup>2</sup> points out that the correction of hyperphoric errors with prisms may relieve the patient's symptoms but will not cure them; and he emphasizes the importance of cure, where it is possible, because hyperphoric errors may be a serious handicap to the individual. For example, prisms in glasses would be of little help to the many youths

who wish to become aviators. The army and navy air-corps standards are high, and where the phoria is in excess of the permitted standard, entrance is not permitted. Entrance into other fields is likewise barred by muscle imbalance. The prescription of prisms in glasses for the correction of symptoms is not directly within the scope of this paper. However, since the two subjects frequently overlap, and are even confused at times, it is well to mention the problem and point out the difference between the two procedures, namely prisms for correction and prisms for the relief of symptoms.

Two very good examples for which the latter procedure is appropriate are the use of prisms in glasses for paralysis of divergence and their use for paralysis of convergence. In paralysis of convergence, prisms base in should be prescribed. In this condition the patient experiences crossed diplopia within a certain distance, usually nearer than 36 inches. The images become further separated as the object is brought closer to the eyes. The prisms are usually limited to use in near work and the amount required will be that required to superimpose the images at the reading distance. In paralysis of divergence the condition presents the opposite picture. Here binocular vision is normal from about 2 to 10 feet, outside of which diplopia exists. The double images are homonymous and become further separated the farther away the object is from the eyes. In this case prisms base out are used for distance vision and that amount of prism is provided which superimposes the images at 20 feet.

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# NOTES, CASES, INSTRUMENTS

## DERMOID TUMOR OF THE SCLERA

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Orbital and epibulbar dermoid tumors are not so uncommon as to be extremely rare. While the orbital variety is the more frequent in occurrence, the epibulbar tumors are the more interesting since they afford more opportunity for observation and study. On the bulb their most frequent site is in the conjunctiva, where they are freely movable over the globe; next in frequency are those firmly fixed at the corneoscleral junction. In the literature and in the textbooks (Duke-Elder,<sup>1</sup> Parsons,<sup>2</sup> American Encyclopedia of Ophthalmology) little or no mention is made of dermoids of the sclera.

Duke-Elder<sup>1</sup> and Collins and Mayou<sup>3</sup> state that, "on the surface of the eyeball in the upper outer quadrant congenital growths are sometimes found containing bone, hyaline cartilage, or acini-tubular gland tissue resembling lacrimal gland. These growths are entirely in the conjunctiva being freely movable over the sclerotic. . . ." A tumor similar in appearance except that it had its origin in the lower temporal quadrant of the sclera is here described.

### CASE REPORT

A male infant, 24 hours old, was seen in consultation. A small, round, angry-red tumor (5 by 4 by 3 mm.) was observed projecting between the lids of the right eye near the external canthus (fig. 1). It appeared to lie in a sulcus or "coloboma" of the lower lid from the inner surface of which a rather dense web fanned out to become firmly attached to the tumor. The lower cul-de-

sac was uninvolved, a probe could be passed freely between the tumor and the lid. The tumor was hour-glass shaped with its base firmly attached to the sclera.

The parents were advised to postpone removal for several months, when the child could safely be given a general anesthetic. Ten days later, because of the

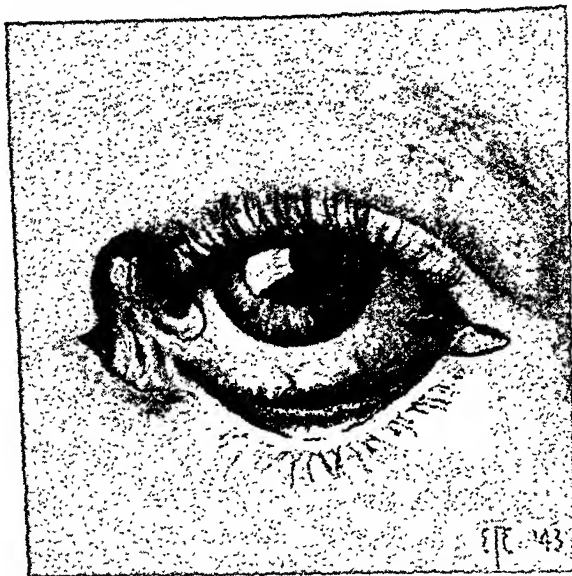


Fig. 1 (Carter). Dermoid tumor of the sclera in a 10-day-old infant.

anxiety of the parents, operation for removal of the growth was performed under local anesthesia (pontocaine, 0.5 percent; novocaine, 2 percent). Attempts to inject the scleral attachment of the tumor were unsuccessful because of the bony hardness. The surrounding bulbar conjunctiva and lid attachment were infiltrated with novocaine, and one large conjunctival vessel going to the tumor was tied off.

The weblike connection between the lid and the tumor was severed at the lid margin, giving free access to the growth. After several attempts, the tumor was finally cut through with a pair of Stevens scissors flush with the sur-



rounding sclera. A dark bony base remained, no doubt a portion of the tumor, but no effort to remove more tissue was made for fear of entering the globe. The wound was closed by two overlapping conjunctival flaps. The rounded edges of

of ulceration with some associated small round and polymorphonuclear cell infiltration about the ulcer. There are sebaceous glands, an occasional one being dilated, and a few sweat glands. There are numerous groups of tubulo-alveolar



Fig. 2 (Carter). Photomicrograph of dermoid tumor of the sclera, showing epidermis, sebaceous glands, and bone.

the V-shaped "coloboma" of the lid were scarified and the defect closed by four interrupted black-silk sutures, two through the tarsal plate, one mattress suture through the lid margin, and one through the skin.

Recovery was uneventful and the sutures were removed on the tenth post-operative day.

*Microscopic examination:* "The specimen (fig. 2) is skin and subcutis. The epidermis is thickened and has one area

glands, apparently well differentiated lacrimal glands. In the center of the piece there is a mass of bone and osteoid tissue in association with a proliferation of anaplastic cells which have hyperchromic nuclei, little cytoplasm, and which are quite variable in shape. This tumor is malignant.

*"Diagnosis:* Mixed lacrimal-gland tumor with malignant changes."

Drs. Parker Heath and Plyn Morris were of the opinion that considering the

age of the patient the character of the cells was not unusual. In their opinion the tumor was a nonmalignant dermoid.

#### COMMENT

Dermoids of this character have generally been classified as teratomas, but Collins and Mayou choose to regard them as an atavism of tissue, since the corium of the skin in some animals is capable of producing cartilage and bone in the form of the exoskeleton. To them the Verneuil theory of dermal inclusion

inclusion theory. The fact remains, however, that there was in appearance no apparent loss of lid substance and that upon repair, as in any simple laceration, there was no shortening of the lid.

Thus on the basis of these findings one might assume that an amniotic band or bands gave rise not only to the tumor but were instrumental in a mechanical way in bringing about the lid defect.

Twelve months following removal of the growth (fig. 3) there is a moderate thickening of the conjunctiva in the



Fig. 3 (Carter). Appearance of eye 12 months after removal of tumor.

seems the most logical. Parsons<sup>2</sup> also expressed it as his opinion that this theory was strongly supported by the site of the election of these tumors, situated as they are at or near the fetal clefts or sutures. That a certain number of them represent the residue of amniotic bands, Duke-Elder<sup>3</sup> is "tolerably certain."

In the case here under consideration Herrenschwand's hypothesis of an organic adhesion of the lid margin to the surface of the globe as a possible cause is in part at least borne out by the rather heavy bridge of tissue spanning the cul-de-sac from lid margin to tumor. On the other hand, the fact that the lid defect was in such intimate contact with the tumor lends ample support to the dermal-

lower temporal quadrant but no evidence of recurrence. The fundus is entirely normal except for some grayish discoloration, but there is no elevation of the choroid at the extreme periphery in the lower temporal region. There are no colobomata of the iris or choroid nor other congenital anomalies. The left eye is normal.

A somewhat similar dermoid cyst, the base of which was "substituted for the conjunctiva, sclera, and choroid coats of the eye," was described by Miller.<sup>4</sup> An interesting case report was also published by Calhoun<sup>5</sup> of a dermoid tumor of the cornea and conjunctiva associated with a scleral ectasia in the lower nasal quadrant.

## SUMMARY

An unusual case of congenital epibulbar tumor is described which involves the conjunctival, scleral, and probably choroidal coats of the eye. The microscopic section showed the presence of cutaneous and subcutaneous tissue, sebaceous and sweat glands, numerous groups

of tubulo-alveolar (lacrimal) glands, and a central mass of bone tissue. There is associated with this a "coloboma" of the lower lid.

Three possible causes of such a tumor are described, but no definite conclusion has been drawn in this instance.

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## THE TECHNIQUE OF TONOM- ETRY AND CARE OF TONOMETERS

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Possession of an accurate tonometer, proper care of the instrument, correct technique in using it, and complete recording of the tonometric findings are the four requisites of reliable tonometry.

Since neither textbooks nor ophthalmologic magazines contain explicit instructions concerning the subject mentioned in the title of this paper, the author has deemed advisable to submit the rules followed at the Glaucoma Clinic of the Manhattan Eye and Ear Hospital of New York.\*

*The tonometer.* The instrument must be reliable, certified as to accuracy of performance by a recognized "checking station."

*The care of the instrument.* The tonometer must be kept *clean* and *aseptic*—

the same rule applies to the box in which it is deposited.

Cleansing is effected by wiping the interior of the cylinder, the foot plate, the foot of the plunger, and the testing block—first with a piece of cotton wound tightly around a toothpick and immersed in 50-percent grain alcohol, then rinsed off with sterile water and dried with cotton.

This procedure must be followed after each tonometric examination and, again, once before the day's consultation hours. (Now that epidemic keratoconjunctivitis is prevalent in many sections of the country, it is timely to warn against infractions of the rules of asepsis.)

If available a separate tonometer should be used for septic cases; if not available, the tonometer must be cleansed with great care after such measurements; if only the one eye is infected, the tonometer should be applied first on the clean eye.

*Technique of tonometry.* (a) The examiner washes his hands with soap and water before and after each tonometry. (b) The instrument is to be manipulated gently by holding the handle between the thumb and adjoining two fingers—the

\* The Glaucoma Clinic at the Manhattan Eye and Ear Hospital of New York is sponsored by the National Society for the Prevention of Blindness.

pointer and hammer are not to be handled. (c) Check the tonometer on the testing block to see whether the pointer stops at the zero division. (d) In applying the instrument, the examiner faces it squarely so as to avoid a parallax error in reading the scale. (e) He holds the instrument *vertically*, so that the axis of the patient's eyeball and that of the tonometer are in one straight line. (f) The foot plate must cover as exactly as possible the center of the cornea. (g) The eyelids are gently separated without the exertion of any pressure on the eyeball. (h) If the eyeball is deeply set in the orbit, it is often necessary to obtain the help of an assistant, who pulls down gently the lower lid while the examiner retracts the upper lid, just enough to allow the foot plate to cover the central portion of the cornea. (i) The entire procedure is to be made in a calm and gentle manner, so that the patient should be given a chance to coöperate without becoming anxious or tense. (j) If the instrument and the technique are correct and if the patient is relaxed and coöperative, two or three consecutive applications (of the tonometer) will give the same reading or a difference not greater than one-half a division. (k) Avoid covering the patient's second eye in the process of keeping the lids apart, or with the hand holding the tonometer.

*The patient* is placed on a table or reclining chair with the face directed straight up; the collar is loosened to prevent pressure on the jugular vein, thereby increasing the intraocular pressure.

One drop of a weak anesthetic (ponto-caine 0.25 to 0.50 percent or butyn 0.50 percent) is instilled twice at an interval of 10 seconds (preferably above the limbus corneae while the patient is looking down). Ready, within one minute, the patient is told to direct his eyes straight up to a target on the ceiling or preferably to his own hand, held in a suitable posi-

tion indicated by the examiner. Any deviation from the straight-up position leads to errors in measurement. In some apprehensive patients, coöperation and steadiness of gaze are secured by asking the patient to watch the target, whether it changes color during the examination ("whether it is becoming blue or green"). This induces the patient to concentrate on something else than on his own fear.

Unruly or overanxious patients have to be carefully trained before the tonometric reading can be relied upon; this applies especially to one-eyed patients.

At the conclusion of the procedure, one drop of 10-percent argyrol is instilled in each conjunctival sac and the eyes are irrigated with salt or boracic-acid solution—just enough to clear the eye of some of the argyrol. (In very rare cases, patients are allergic to argyrol.)

*Recording the tonometric findings.* The following data must be recorded: (a) date and hour of day; (b) the reading on the scale; (c) the number of hours or days since last instillation of the miotic; (d) the name and dosage of the drug used; (e) the strength of the miotic and frequency of instillations.

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## A NEW SUTURE FOR USE IN MUSCLE-RECESSION OPERATIONS

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For some time, Wendell Hughes of New York and others have used, in children, a modification of the Jamison technique. A double-armed suture is placed vertically, passing through the superficial layers of sclera, crosswise to the direction of the fibers, at the point of selection. The suture is passed through correspond-

ing points in the muscle and tied in a surgeon's knot.

The writer has used this method in adults with uniformly good results.

A further simplification and extension of the modification is now suggested.

Before the tendon is cut, and after the muscle hook has isolated the tendon, and is still in place, a single-armed suture on a cutting-edge needle is passed through the tendon, about one fourth of the distance from one edge, from scleral side toward conjunctival side, and back through the tendon toward the sclera, at a corresponding point one fourth of the distance in from the opposite edge. This may sound complicated, however it is extremely simple. Lifting the muscle hook like a lever exposes the required edge of tendon and provides plenty of space for the passing of the needle. The tendon can then be severed from its scleral attach-

ment, the suture being retained as a stay suture. At the point of selection, the scleral bite crosswise to the scleral fibers can be made, going, of course, in the direction opposite to that of the initial passage through the tendon. Upon emergence from the scleral fibers, the suture is passed from scleral side to conjunctival side through the tendon, just inside the first entry. The suture can then be tied without too much tension. The tendon is well flattened down and in good approximation to the sclera.

This method has the advantage of using only one suture, and that of a saving of tendon. (Many small recessions are neutralized by the shortening involved in placing sutures behind a muscle clamp.) It can also be used in cases where a muscle clamp is not available. The value of such a procedure in war surgery is obvious.

*52d Station Hospital.*

# SOCIETY PROCEEDINGS

EDITED BY DR. DONALD J. LYLE

CHICAGO OPHTHALMOLOGICAL  
SOCIETY

CHICAGO LARYNGOLOGICAL  
AND OTOLOGICAL SOCIETY

JOINT MEETING

February 8, 1943

LOUIS G. HOFFMAN, *president*,  
Chicago Ophthalmological Society

G. HENRY MUNDT, *president*,  
Chicago Laryngological and Otolological  
Society

SYMPOSIUM ON HEAD AND FACE PAINS  
(Abstract of Proceedings)

## INTERNAL MEDICINE

DR. G. W. SCUPHAM. The lay public has been so well educated to the fact that eye strain and eye diseases are frequent causes of headache that they will go to the ophthalmologist, and the otologist has his turn because of the belief that sinus headaches are common. It is a difficult problem because of the multiplicity of causes of which headache is the outstanding symptom. From the standpoint of the internist, not only is the diagnosis difficult, but the therapeutic problem is often more so. If we limit ourselves to any one of the fields of medicine in which headache is important we are likely to fail to arrive at a conclusion in a particular case.

A number of mechanisms may result in various types of headache, but so far as head and face pains are concerned, these are not so important. Pain may be the result of local diseases or local reflex phenomena. Some blood-vessel disorders are characterized by pain. Arteritis of the temporal vessels does result in a throbbing, burning type of pain localized

in the region of these vessels, often associated with evidence of an inflammatory process. Herpes zoster is a fairly common cause of head pain. Tumors of the scalp and skull, multiple myeloma, and osteitis of the skull might also be mentioned.

Headaches are more important to the internist than head and face pains. The character of the pain seems to be different. Headache arises within the head, whereas head and face pains are more or less superficial. Headache is extremely variable in different individuals. It is uncommon in children, and in aged individuals it is less common than in middle adult life.

The majority of headaches are those which are merely part of the general symptomatology of the disease picture. In almost all acute infections headache is an important symptom. Typhoid fever is often characterized by long-continued headache; influenza and acute respiratory infections by headache at the onset. An example of toxic headache is that resulting from sulfathiazole; alcohol is also a cause of this type; carbon-monoxide poisoning is also toxic, but often results in structural changes. In acute nephritis, headache, associated with nausea, is an important symptom of the onset of the disease. It is in part toxic but there may be a rise in intracranial tension; in the uremic phase of chronic nephritis the headache is probably toxic. Headache is a common and extremely important symptom in chronic malaria, is persistent and severe, and disappears with control of the disease.

Hypertension is the major vascular disease in which headache is important. The

inhalation of amyl nitrite results in headache and fall of blood pressure. This is an interesting contrast in the mechanism of headache, as in persons having hypertension a fall in blood pressure often overcomes the headache. Many with severe hypertension never have headache, and many with moderate hypertension complain of severe throbbing headache, often continuing for days without marked exacerbation of the blood pressure. In general, patients whose hypertension is in the malignant stage are subject to severe headache, probably because there is marked vasoconstriction of the arterioles of the central nervous system.

The headache that resembles the type caused by injection of histamine, may be confused with migraine because it is often unilateral. There is no history of familial headache. The headache often begins at night. There is often flushing of the head and face on that side, tenderness of the temple and over the carotid artery. Pressure on the carotid may result in relief. A small amount of histamine injected subcutaneously can initiate an attack. The recognition of this type is important because relief may be obtained by the therapeutic administration of histamine.

There are a great variety of rheumatic headaches, from that of acute rheumatic fever, which may be mistaken for brain tumor, to a mild occipital headache of chronic nature. Perhaps the common type is associated with fibrositis and myositis as well as with cervical osteoarthritis. Such headaches occur with increased tension of the muscles of the spine and neck.

Reflex headache is more difficult to differentiate. It is often associated with disease of the pelvic structures. Constipation is said to cause headache reflexly and evacuation of the lower bowel brings relief.

The typical features of migraine headache are well known. The family history

is so common that if we do not find it we doubt the diagnosis. There is a slow development of headache with nausea and vomiting, relief and sleep, often preceded by aura. It is extremely variable in some individuals, and it sometimes disappears at or near the menopause. Another striking feature is the association with the menstrual cycle. Migraine may be precipitated by a wide variety of factors; food allergy, emotional states, certain endocrine abnormalities, particularly the gonadotropic factor, fatigue, infection, and many others. It is commonly thought to be incurable, but much can be done if the problem is studied. Treatment should be directed toward elimination of the exciting factors when possible.

#### NEUROLOGY

DR. LEWIS J. POLLOCK. When a stimulus is applied to the skin or mucous membrane on the exterior of the body, sensation is transmitted by the sensory fibers of the craniospinal nerves and reaches consciousness directly through their appropriate sensory tracts. Thus, inflammatory and other pathologic processes of the skin and mucous membrane produce stimuli carried by ordinary sensory cutaneous nerves and are localized by one to the area stimulated.

When the subcutaneous areas are stimulated, sensation is transmitted in two ways: first, by the ordinary sensory components of craniospinal nerves carrying deep sensibility—in the case of the head and face, by way of the sensory components of the 3d, 4th, 5th, 6th, 7th, 9th, 10th, 11th, and 12th cranial nerves; second by a more complicated mechanism producing referred pain—as an example the shoulder-tip pain occurring when the central portion of the diaphragm is stimulated by diaphragmatic pleurisy. The impulse travels by way of the phrenic nerve through the posterior roots of the 4th



and 5th cervical nerves to the spinal cord, there making a synapse with the descending short fiber tracts to the points of origin of the cervical sympathetics, then through the preganglionic and postganglionic fibers to the skin, where a chemical change is produced stimulating the sensory end organs, and sensation is then carried by the sensory spinal nerves into the spinal cord and by its appropriate sensory tract into consciousness. The location of pain is then referred to the skin over the shoulder tip.

The same mechanism applies to the head and face. In the case of vascular headaches, and perhaps migraine, stimuli occur as the result of dilatation of the blood vessels; impulses travel by way of the *nervi vasculorum* originating in the cranial nerves, perhaps also upper cervical, and find their way into the brain stem and medulla; there a synapse with the short descending pathway of the cervical sympathetics occurs; impulses are sent over the postganglionic fibers to the skin, where again chemical changes produce a stimulus in that area, and impulses carried by the particular sensory nerve involved, chiefly the fifth but also others, enter the brain stem. This holds true also of distention of other subcutaneous tissue as well as traction on the meninges and dural sinuses. This can be proved by experiments in which the pain ensuing from faradic stimulation of the superior cervical ganglion can be stopped by section of the sensory root of the fifth nerve. The pain cannot be stopped by severing the preganglionic fibers when the appropriate anterior roots are severed or by cutting the cervical sympathetic chain below the superior cervical ganglion.

Usually head pain does not occur as the principal symptom of intracranial disease; although headache may be the presenting symptom, it is not the sole symptom in intracranial tumors. Diplopia,

hemiparesis, facial paresis, ataxia, loss of visual acuity, vomiting, and mental disturbances are always at times associated with the headache. Headache when present is associated with vomiting which may be projectile in character and usually does not lead to alleviation of pain. Here the headache is sharp and severe and continuous; it may be a throbbing, stabbing, boring pain. It is often brought on by sudden change of posture and may disappear by changing the position of the head; in intraventricular and infratentorial tumors, the patient may hold his head in a position which tends to lessen the possibility of occurrence of pain. It may be associated with suboccipital tenderness and rigidity of the neck. It is increased on jolting and straining and, with sudden exacerbation of pain, vomiting may occur.

The location of pain is not characteristic, nor is it an index of localization of the tumor. The character of the tumor may influence the type of headache and its severity. Rapidly growing tumors are associated with more headaches; hard tumors cause more pain; circumscribed tumors produce pain of greater intensity than do infiltrating tumors. Tenderness to percussion of the skull at times serves to bring out an area of circumscribed tenderness which may indicate intracranial disease.

Associated signs and symptoms lead to the diagnosis. Hemiplegia of sudden onset points to hemorrhage, thrombus, and embolism; the sudden onset of excruciating suboccipital pain with loss of consciousness, rarely hemiplegia, and rigidity of the neck, characterize subarachnoid hemorrhage, usually due to ruptured cerebral aneurysm. Inflammation of the leptomeninges, alone or with encephalitis, is associated with rigidity of the neck, Kernig's sign, and Brudzinski's sign; and evidence of inflammatory disease is found on examination of the cerebrospinal fluid.

Serous meningitis with paroxysmal hydrocephalus is characterized by the occurrence of definite attacks of headache, vomiting, sometimes choked discs, and signs of interference with cerebral function. Such attacks, after a relatively short course, may disappear and a considerable time elapse before another occurs. In such cases one may often obtain a history of another phenomenon of anaphylaxis, as angioneurotic edema or Menière's syndrome.

Most cerebral diseases produce interference with function of motion, sensation, tone, synergy, speech, reflexes, and cranial nerves. No more than a consistent difference in the activity of deep reflexes upon the two sides may be noted, but when this is combined with diminished superficial reflexes on the same side it is a strong indication of organic disease. Changes in the visual field may be found long preceding change in the optic nerve, especially in temporal-lobe lesions, wherein a quadrantic anopsia and a headache may be the sole symptoms of tumor. Whether encephalitis uncomplicated by meningitis can produce headache cannot be stated. Many of the encephalitides are associated with meningitis, and in lead encephalopathy a marked change in renal function may be present, which in itself may produce marked headache.

In a very large number of patients suffering from headache careful search reveals no organic disease. Such headaches may be termed "psychogenic," or, perhaps better, headaches associated with neurosis. Usually the patient does not mean that he has pain in the head when he complains of headache. It is a feeling sometimes describable, at times not; always it is "intense," "terrible," "horrible," "splitting," "unbearable." It is the hyperbole and exaggeration which point to the condition. The sensations complained of

are also myriad. The so-called pain may involve any part of the head, and shifts from day to day or from hour to hour. It is continuous, is usually unaffected by weather or by ordinary changes in position. It is not accompanied by nausea or vomiting. It is always increased by making decisions and always by work. It is relieved by reassurance, whether by a physician's statement or by favorable observations by the patient. If the patient becomes interested in any pursuit, so long as the interest lasts the headache will abate; it is abated by any new treatment or doctrine. It is worse in crowds, and is increased by excitement, disputes, quarrels, and domestic, social, and business conflicts.

As is the case with sensations relative to phobias relating to the heart or stomach, so with this headache. A real pain or discomfort of organic origin may often have preceded it; it may follow a migraine, an indurative, ocular, or sinus headache, or may coexist with them. Prominent among the symptoms are depression, abulia, inattention, difficulty in concentration, forgetfulness, introspection, anxiety, fears, indecision, fatigue, and insomnia. It is important not only to distinguish these headaches from organic headaches, but it must be remembered that they may be the beginning of a more serious condition, a beginning melancholia, dementia praecox, or dementia paralytica.

Often pain in the head or certain types of headache are classified as neuralgia; namely, auriculotemporal, occipital, and so on, neuralgia. This I believe is a mistake. If we accept trifacial neuralgia as characteristic of the neuralgias, then sudden paroxysms of severe pain in the distribution of the sensory supply of the nerve, lasting only a fraction of a second, and brought about by touching a

trigger or algigenetic zone, are seen only in relation to the trigeminal or glossopharyngeal nerve.

The characteristic neuralgia affecting the trigeminal nerve is observed usually when no underlying pathology can be demonstrated even when the gasserian ganglion is inspected. At times it occurs in relation to tumor of the gasserian ganglion, angle tumors rarely, and multiple sclerosis. It is not related to any other extraneural disease, as disease of the sinuses, teeth, or other structures of the head and face. The characteristics of the pain are unique. The pains are always referred to the same zone, supraorbital, infraorbital, or mental, or two or all of the branches. They may occur seemingly spontaneously but can always be brought on by touching the area which is the trigger zone, or by movements stimulating such a zone—talking, chewing, swallowing. The area stimulated is not always the area in which pain ensues. The pains are very severe, sharp, shooting, electriclike, last but a few seconds, or may consist of a succession of shorter ones. There is no relief other than interruption of the sensory fibers of the fifth nerve.

#### ALLERGY

DR. SAMUEL M. FEINBERG. From the standpoint of allergy there are two main types of headaches: the classical migraine and the simple but frequently recurring headaches. We believe there is no real etiologic distinction between the types; the migrainous are merely a more severe form. We have observed many patients whose ordinary recurrent headaches go on into migraine, and other patients whose headaches vary from the simple to the typical migraine at different times.

What is the mechanism of migraine? It has been demonstrated that angioneurotic edema produces cerebral symptoms and

that cerebral vessels have a vasomotor control. Several years ago a young woman who had violent migrainous symptoms was finally operated on for suspected brain tumor. Marked edema of the brain was noted but no tumor was found. Following the operation she had a defect in the skull. It was now observed that the onset of a migrainous attack was initiated by a preliminary pallor of the face and depression of the skull area. As the attack progressed there developed definite bulging of the decompressed area. Allergy studies showed definite clinical sensitivity to specific foods and the latter precipitated the headaches and the bulging of the defect. It would appear, therefore, that the mechanism of migraine is probably a cerebral angiospasm followed by vasodilation and increased intracranial pressure.

What evidence have we for the allergic basis for headaches? Dr. Scupham has already mentioned the great tendency to heredity in migraine. The majority of patients give a family history of migraine, but a large percentage also give a history of other allergy in the family. It is generally overlooked that in allergy not only is there a general tendency to the inheritance of allergy but a special tendency to have certain allergic manifestations predominating in the family. Antecedents with urticaria are more apt to have offspring with urticaria than other allergy; antecedents with migraine are more likely to have offspring with that disease than any other allergic manifestations. The fact that migrainous attacks are frequently precipitated by nonallergic factors such as fatigue, constipation, excitement, weather changes, and endocrine cyclic phenomena does not detract from the allergic concept of the disease. We know that such precipitating causes can be instrumental in being the "trigger" to other

allergic phenomena such as asthma, rhinitis, and urticaria. It is true that only a small proportion, perhaps a fourth, respond to skin tests, and yet we find that in some of the other allergic manifestations, such as urticaria and gastrointestinal allergy, the incidence of skin reactions is also small. By clinical means and observation we can assure ourselves that many patients have their headaches from foods in spite of negative skin reactions.

By the use of skin tests, simple observation, diary records, and restricted diets we can usually make a diagnosis. We may say conservatively that in half of these cases allergy can be demonstrated; as to the others we believe no satisfactory explanation exists at present. The majority of the allergic patients are sensitive to foods, the most common of which are wheat, milk, cocoa, peas and beans, potato, pork, egg, and onion. It should not be forgotten that inhalant allergens may also cause migraine.

#### ENDOCRINOLOGY

DR. HUGO R. RONY. It may be expected that endocrine glands play some role in the etiology of headache for three reasons: (1) Two glands, the hypophysis and the pineal gland, are located in the intracranial cavity; (2) hormones are known to affect secretion of the cerebrospinal fluid as well as retention of water in various tissues, including possibly the meninges and brain; (3) glands participate in a number of factors known to be concerned in the production of headache—control of blood pressure, certain metabolic processes, the autonomic nervous system, the level of sugar, calcium, sodium, and other components in the blood.

It is difficult to obtain reliable statistical data in regard to the frequency of endocrine headache, inasmuch as the diagnosis of endocrine disturbance is some-

times a matter of opinion. Further, even in the presence of definite endocrine disturbance, its role in the production of the headache in a given case may be open to question. It is probably safe to say, however, that the number of cephalalgias in which glandular disturbance is a contributory factor is quite great, whereas true or primary endocrine headache is relatively rare.

In tumors and hyperplasias of the hypophysis headache is a prominent symptom; it is more or less constant, bitemporal, or occipital. It is believed to be due to distention of or pressure upon the capsule of the gland or the dural diaphragm above the gland. Eosinophilic, basophilic, or chromophobe tumors may produce this headache regardless of the functional state—deficiency or hyperactivity—of the gland. Removal of the tumor or deep X-ray therapy may completely relieve the headache. There is some evidence that the headaches of pregnancy, artificial or natural menopause, and so-called premenstrual headaches may be of pituitary origin, probably due to mechanical effects of the hyperplasia of the gland known to occur in these conditions. Such headaches may be successfully treated by large doses of estrogenic hormone preparations which are known to exert an inhibitory effect on pituitary hyperplasia.

Tumors of the pineal gland may produce severe headache of the type seen in brain tumors, especially if they lead to compression of the Sylvian duct and cause internal hydrocephalus with consecutive increase of intracranial pressure.

Headache is not infrequent in disturbances of the thyroid gland, either hyper- or hypothyroidism. Such headaches are usually mild with no characteristic localization. That they are related to the thyroid disturbance is shown by the fact that they are relieved by specific therapy, ad-

ministration of thyroid substance in hypothyroidism, or thyroidectomy in hyperthyroidism.

Headache is a prominent symptom of Addison's disease or other forms of adrenal insufficiency, and may be relieved by administration of adrenal cortex extract. In hyperinsulinism, headache may be an element of the hypoglycemic syndrome. Characteristic of this headache is its onset when the stomach is empty, with prompt relief after food intake. Hyperglycemia, on the other hand, does not in itself produce headache; however, headache frequently accompanies diabetic acidosis, and severe headache in the uncontrolled diabetic may be a danger signal of impending coma.

Headache in various conditions of doubtful glandular etiology may present a considerable diagnostic and therapeutic problem. Thus it may be difficult to decide whether headache in patients with a hypotension-fatigue syndrome, certain ovarian disturbances, or male climacterium, and the like, is of glandular or psychogenic origin. Even therapeutic success with specific glandular preparations may not answer the question of the nature of the headache, in view of the possible suggestive effect of treatment. In certain forms of obesity, especially when accompanied by hyperostosis frontalis interna (Morel's syndrome) or by painful lipomatosis (Dercum's disease) headache may be a prominent complaint. Reduction of weight in such cases is usually followed by more or less complete relief of the headache, probably because of the lowering of blood pressure and lessening of water retention as a result of loss of weight.

#### OPHTHALMOLOGY

DR. BEULAH CUSHMAN. Patients with headache come to the ophthalmologist

sooner or later, as it has become almost a maxim that errors of refraction and muscle balance cause headache and asthenopia, and this belief is fostered by advertisements. The eye is particularly sensitive to neurosis since it is a highly specialized organ.

Of the 12 cranial nerves 4 go directly to the eye and 3 have distributions to the eye. The extensive distribution of the fifth nerve from the midbrain down to the second cervical level and the numerous interrelationships which it forms with the nuclei of origin of all the other cranial nerves, constitutes one reason why headaches so frequently result from many different causes and are so vague in distribution. The association of the trigeminus with the vagus accounts for the vomiting which accompanies acute glaucoma. This also explains the relief of dyspepsia obtained by proper correction of errors of refraction and muscle balance.

Ocular headaches have been divided into three groups: those due to retinal irritation, those due to organic disease, and those due to eyestrain.

Retinal irritation may follow glare with any sudden change of environment from a dull to a bright light, or with the use of a torch in industry. The range of sensitivity varies with the individual, partly according to the amount of pigment in the retinal pigment layer and choroid. Ophthalmic migraine, a rare condition, may be precipitated by glare, and is the type which has been described as associated with palsy of an ocular nerve, generally the third; at first the palsy is temporary, later becoming permanent. The pain is diffuse, beginning in the temporal region and spreading to the occiput. Pain and nausea always precede the paralysis. The pain in ophthalmic migraine is usually on the same side as the hemianopia, whereas in typical mi-

graine the pain is on the opposite side. The paralysis, which may involve the iris and muscle of accommodation, usually passes off in the first attack. The attacks occur only a few times during the patient's life, but each attack may continue for days, weeks, or months. The involvement of the oculomotor nerve has been constant in all published cases, but the pathologic pictures show no uniformity.

Organic diseases produce ocular pain according to the degree of abnormality of the ocular nerves and muscles. Foreign-body sensation and discharge are present with inflammation of the conjunctiva, cornea, and sclera.

Ciliary neuralgia is the type of pain present with iritis and cyclitis, is usually worse at night, and varies in intensity. Neuralgia of the eye has also been described as pain on movement of the eye and tenderness of the ocular muscles after exposure to cold air. Closely allied to this condition is neuralgia of the forehead. The symptoms may be associated with transient paresis, which responds to heat and salicylates.

The pain in acute glaucoma extends along the distribution of the fifth nerve. In cases of chronic glaucoma and secondary glaucoma there may be neuralgic type of pain referred to the face, cheek, and temporal areas, often mistaken for sinus infection until the vision becomes affected.

Retrobulbar neuritis produces a pain deep in the orbit, increased upon rotation of the eye; this pain may be present several days before blurred vision develops.

Pain in proptosis, as found in thyrotoxicosis, orbital tumor, and cellulitis, varies according to the degree of distortion of the ocular muscles and nerves and exposure of the cornea.

A refractive defect present for many years is unlikely suddenly to exert a malign influence according to Butler, unless

some other factor is added—overstudy, work under unfavorable conditions, debilitating illness, and psychic disturbances. Headaches of recent origin should be due to a recent cause.

Ophthalmic headaches are presumed to be due to overwork of the muscles of accommodation and fixation; the height of pain is reached late in the day and disappears after rest. The infrequency of headaches in persons with monocular vision is said to be due to absence of effort made for fusion through complex actions. Overaction of the ciliary muscles controlling accommodation producing fatigue and spasm may be followed by headache. Refractive errors predispose to headache, as does muscle imbalance. The insertion of the frontalis muscle into the upper lid of each eye participates in the contraction of the orbicularis palpebralis; the frontalis on contraction pulls on the epicranial fascia, and this in turn pulls on the occipital muscles causing fatigue and spasm.

Headaches of ocular origin are probably most often found in the presbyopic who have a receding near point. Many persons complain of ocular discomfort, who have high degrees of hypermetropia and astigmatism or heterophoria, which had caused no previous handicap. Aniseikonia is a cause of discomfort in patients with unrelieved symptoms of asthenopia or photophobia. This may be suspected in anisometropia in unequal accommodation with lenses of unequal curve or thickness, space-perception anomalies; and in the patient with good vision in each eye who prefers to use one eye only and occasionally in a patient with reading disabilities or migraine.

#### OTOLARYNGOLOGY

DR. ARTHUR W. PROETZ. Reliable statistics indicate that probably less than 5 percent of headaches are due to sinus



trouble. Undue emphasis has been given to sinus headache by the public, which has been recently plied with semitechnical literature on sinusitis while being kept in ignorance of the other 30 causes of headache. The physician must guard against accepting the patient's diagnosis merely because some sinus infection is present. Many people have headache; many people have sinus infection; the two are often not related.

While the mechanism of headache is not known, much light has been thrown upon it in recent years. It is usually associated with stretching or distortion of certain definite portions of the meninges or with the dilatation of certain arteries, notably the middle meningeal. The sinuses are closely related to these structures. Congestion and inflammation in the sinuses may produce typical headache.

However, these disturbances may not be peculiar to the sinuses themselves but may be of a vascular nature and result from conditions elsewhere in the body. It is my impression that there are people who are headache subjects; that is, that many stimuli of various types produce vasomotor disturbances which set up the headache mechanism and produce the symptom typical of the individual.

Mere stretching of the nasal mucosa does not produce pain. A number of cases have now been observed of sudden edema stretching the sinus lining to 10 times its normal thickness without inducing any subjective symptoms. It does not follow that stretching of the periosteum would be painless. This may be analogous to a diffuse otitis externa, which is exceedingly painful.

The existence of a "vacuum" pain of any duration is open to doubt. I can find no evidence in the literature of any experimental proof that it exists. No physiologist whom I have consulted is willing to say that the sinus mucosa absorbs oxy-

gen. It is pointed out that a system of tissues may react specifically in absorption or secretion of a gas. If no selective action exists and only the usual exchange of gases occurs in a sinus, then as much carbon dioxide must be given off by the membrane as the oxygen which it absorbs, and since carbon dioxide has a slightly greater volume than oxygen, a *positive* pressure must result if the ostium is closed.

Another mechanism may be at work which I have not seen described: sudden engorgement or sudden collapse of a sinus membrane in the presence of a closed ostium may conceivably produce positive or negative pressures. Whether these produce headache I do not know. In certain individuals slight exhaustion of air from the nasal fossae does produce headache.

Observation of pain in cases of known acute sinus activity, namely, acute empyema of the frontal and maxillary sinuses, leads to the conclusion that pressure *on an acutely inflamed area* causes severe pain. When the pressure is relieved the character of the pain changes. Although the mucosa is still acutely sore, the pain in no way resembles a so-called sinus headache as we understand it. It is not gone in half an hour. We are led to the conclusion that sinus headaches which come and go are the result of vascular disturbances (in or out of the sinus) and not of a fixed pathologic change.

Some nasal headaches can be demonstrated to result from the impaction of jets of air during inspiration against the nasal ganglion or its tributaries. These jets are the result of constricted airways. The direction is determined by the topography of the nose and its irregularities.

It is difficult to obtain a balanced viewpoint from the literature on headache. Many authors are themselves victims of the malady and their accounts and inter-



pretations are often highly tinged with their own experiences. This is entirely understandable, since a symptom so completely subjective can in any case be best studied by its victims.

There remains the problem of practical approach. Anyone seeing many headache patients (and who does not) must be struck by the fact that these people are prone to make their own diagnoses, which lead them to the rhinologist or the ophthalmologist or the dentist or the allergist or, what is more likely, to all of them in succession. They are commonly told, "It isn't your eyes, it must be your sinuses," or "It isn't your sinuses, it must be your teeth." They are seldom told, "Your headache is due to one or two or more of some 30 possible causes and we will try to find out which one it is."

In my own hands, the most direct method of arriving at some indication of the nature of a headache is a complete history both of the headache from the standpoint of the attack and of the background, and of the patient in general. A complete printed questionnaire helps greatly to visualize the case as a whole and to evaluate it. Important also is a complete daily record of the patient's contacts, diet, and activities. Again, a prepared chart with which I am thoroughly familiar has many advantages over a haphazard diary or even a carefully recorded diary according to some system devised by the patient. Since the important points in such a diary are often the minute details, standardized records are of great help.

(Copies of the forms used were projected on the screen.)

In the treatment of vascular headache and, in fact, of some others, to afford relief while investigation is going on, I find <sup>eph</sup>edrine with one of the barbiturates, by mouth, very useful.

I may also add that many headaches

having the characteristics of sinus pains disappear on the administration of thyroid extract. A low basal metabolic rate is not always typical in these patients. I have commonly noted improvement on giving thyroid even when the rate was +5 or more.

*Discussion.* Dr. Peter Bassoe: It might have been well if someone had discussed recent research on the mechanism of headache. At the last meeting of the Chicago Neurological Society, Dr. Harold Wolff reported on the work by his group in New York. They have made innumerable experiments on people whose heads had been opened, and determined that the most sensitive areas are near blood vessels, which is analogous to what is seen in the peripheral nerves. The median and sciatic nerves with their arteries surrounded by nerve fibers are the areas most frequently affected by causalgia.

One speaker is missing on this program; no one discussed teeth. Even in this enlightened age a great many people have been deprived of teeth without good reason. One striking example was a woman with beautiful teeth, who had pain which she localized in a couple of teeth. These were found to be normal upon removal, but then the pain shifted to other teeth, which were also removed, until she had lost many teeth at the time she came under observation. On questioning it was found that she was in a disagreeable situation from which she could see no escape. It was possible to point out to her how this could be straightened out and the pain disappeared and the rest of her teeth remained.

Dr. Feinberg's remarks about edema and allergic conditions causing pain are interesting. One patient developed a syndrome of brain tumor, choked disc, vomiting, severe headache, but no localized signs. A decompression was made and he

was well and had no further symptoms. No tumor was found. He moved to another part of the country and then developed typical angioneurotic edema. Undoubtedly his symptoms of brain tumor were due to edema of the brain.

Another patient, a woman, had sudden severe brain headache, aphasia, and hemiplegia. She had been taking care of a child with scarlet fever, and brain abscess was suspected. She went into coma. The brain was explored and nothing but edema was found. She recovered, but temporary aphasia recurred at each menstrual period, so this was nothing but a severe menstrual edema.

Dr. G. W. Scupham: Dr. Feinberg's conception of migraine as being essen-

tially an allergic phenomenon is generally accepted. It is analogous to asthma in many respects. Although it is not always an allergic factor that precipitates the episode, that does not alter the pattern. Just as asthma may be precipitated by many exciting factors, entirely foreign to allergic influence, so may migraine. The endocrine aspect deserves more consideration. Just what part the endocrines play in the mechanism of production of headache it is difficult to say.

Dr. Proetz's scheme for study of the subject is splendid. When a patient has sinus infection it does not mean that this is the cause of his headache. The same is true of hypertension.

Robert Von der Heydt.

# AMERICAN JOURNAL OF OPHTHALMOLOGY

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*Author's proofs* should be corrected and returned within forty-eight hours to the *Manuscript Editor, Miss Emma S. Buss, 5428 Delmar Boulevard, Saint Louis 12, Missouri*. Twenty-five reprints of each article will be supplied to the author without charge. Additional reprints may be obtained from the printer, the George Banta Publishing Company, 450-458 Ahnaip Street, Menasha, Wisconsin, if ordered at the time proofs are returned. But reprints to contain colored plates must be ordered when the article is accepted.

## REBATES AND THE "AGENCY DISPENSING POLICY"

The Riggs Optical Company has recently announced a new program for the dispensing of glasses to the public. This program is called the Agency Dispensing Policy." While it relates chiefly to business and financial relations between the refractionist and the dispensing optician, certain features are of especial interest to all ophthalmologists in that they apparently give the refractionist the power to regulate somewhat the cost of glasses to the patient. This "Agency Dispensing Policy" as announced is as follows:

1. Dispensing service is available to members of the profession licensed to refract under the laws of the various States in which our Company does business, but

only to refractionists practicing within the territory served by our Company.

2. We act as agent for licensed refractionists who are the principals in the dispensing transactions. Occasionally we also act as agent for other dispensing accounts when properly authorized to do so, on the same basis as we act for licensed refractionists.
3. The licensed refractionist appoints us as his agent to dispense for him through the medium of an agency dispensing letter. He determines the amount to be charged and collected for his account by us, and designates the amount either through a signed pricing schedule or by specifying the amount prior to the time of each transaction.
4. Any variations from his schedule must be authorized by the refractionist and a record kept of the authorization.
5. All transactions are charged to the refractionist upon receipt of the prescription or order.
6. All transactions are for cash where credit

- is not authorized by the refractionist. Unless credit rating is assured, a sufficient deposit is obtained from the patient at the time the order is placed to cover at least the refractionist's material and service costs, and in every case all unpaid amounts are collected at the time of delivery.
7. Where the refractionist authorizes credit and requests us to do the collecting for him, it is understood that if we do so, acting as his agent, the refractionist bears all credit risks. Statements sent to the patient indicate that transactions are for the account of the refractionist.
  8. Agency dispensing accounts are settled monthly. Exceptions to this rule must be requested by the refractionist and agreed to in writing to the refractionist by our Main Office.
  9. Casual transients or "drop ins" are not served. Agency dispensing service is not rendered to patients of refractionists who have not properly authorized us to act as their dispensing agents. In no case is dispensing service rendered to any transient patients of a refractionist located outside of our territory of operations.
  10. No materials are furnished and no services are rendered unless a prescription or order has been received from the refractionist or record thereof is on file with our Company.
  11. All charges to our accounts are based on our current price lists, plus a fixed dispensing fee for the dispensing services.
  12. Agency signs describing our dispensing function and procedure are prominently displayed at each of our dispensing offices.
  13. Serially numbered receipts are tendered to patients from whom collections are made, which state that the collections are made for the account of the refractionist.
  14. The Company reserves the right to decline, through its Main Office, to act as dispensing agent for any refractionist.

August 1943

Riggs Optical Company

The dispensing of glasses to patients concerns the ophthalmologist in two respects: first, his possible participation in the profits resulting from the retail sale, the so-called "rebate system," and second, the price charged the patient for the furnished glasses, which is believed by many ophthalmologists to be excessive.

The participation of the refractionist in the sale of glasses varies between two

extremes. On the one hand, is the example of the practitioner in a small community where there is no direct outlet for the sale of glasses to the patient. There the refractionist, after completing his examination, must measure the patient for the frames, determine the type to be worn, order the finished job from the wholesale house, assume the responsibility for the cost thereof, fit the glasses, when received, on the patient, and finally be responsible for alterations and adjustments. Clearly this refractionist, forced by necessity into the position of a retailer, is entitled to the retail profit as a recompense for his services. On the other extreme is the refractionist who, after completing his refraction examination, gives the patient the prescription and directs him to an optical house to have it filled. Thereafter, his task and responsibility are limited to the usual perfunctory examination of the glasses for accuracy and fit, and to the assumption of financial responsibility in case an alteration in the original prescription is necessary, or credit is injudiciously extended to the patient. This latter contingency appears well guarded against in the "Agency Dispensing Policy." As a reward for these minor services and obligations under one guise or another, the refractionist receives back a fat share of the profit ensuing from the sale of the glasses. Disguise this transaction as you will, and distasteful as the term may be both to the refractionist and the optical house, in its last analysis this is nothing more nor less than a straight rebate. While this "Agency Dispensing Policy" is manifestly an effort to deal frankly with this problem, it is open to the criticism that it cloaks a distinctly unsavory transaction, condemned alike by the national ophthalmological societies and by the public, with the mantle of a respectable business procedure.

Certain features of the new policy are,

however, to be commended. First and foremost, it removes the veil of secrecy from the obnoxious business, and provided the patient takes the trouble to inquire into the meaning of the various placards and signs, and into the significance of the receipt given him, he may learn that the refractionist in addition to the fee paid him for professional services, is also receiving a share in the profit from the sale of the glasses. Secondly, and even more important, provided the Riggs Optical Company does not avail itself of the exit offered by "clause 14," the refractionist who does not wish to participate in the retail profits is given a weapon in "clause 3" with which he may strike at the heart of the rebate system and the excessive charge for glasses finally made to his patients.

Under this clause the refractionist is clearly given the power to determine the amount to be charged and collected from the patient for his finished glasses. While no specific limits are set, the obvious minimum would be the wholesale cost of the glasses charged to the refractionist, plus the fixed dispensing fee charged by the Riggs Optical Company (clause 11), plus a small "cushion" charge to provide against loss or subsequent change. Did the refractionist dictate such a price for the patient there could be no rebate of any kind, and the patient could receive his glasses at a considerable reduction over the present prices charged. The obvious maximum would be all the traffic would bear, subject to such ceilings as might be imposed by a government agency. In this case the refractionist would receive the maximum of rebate and the patient, accordingly, charged the maximum for his glasses. Between these two extremes are various possibilities. The refractionist, while refusing to take any rebate, might <sup>well</sup> feel the patient should properly pay a moderate mark-up on the wholesale

price, and any profit finally accruing might be turned over to a charity or some medical institution. Other refractionists, unwilling to give up entirely their profit from the sale of glasses but nevertheless anxious to reduce the final cost to the patient, might compromise the matter in setting the amount to be charged.

What the reaction of the refractionist, ophthalmologist or optometrist, will be to this new policy remains to be seen. If the refractionists avail themselves of clause 3, and set a lower scale of retail prices than those now generally prevailing, what will be the reaction of the Guild opticians who have heretofore enjoyed the former higher scale of prices? Will they be willing to accept the lower scale, and if necessary make a charge for post-sale service to compensate for their reduced income? Or will they bring pressure on the Riggs Optical Company to avail themselves of clause 14, and refuse the business of those who seek a lower-price scale for the patient? What will be the reaction of other wholesale houses to this policy? Will a movement against the present rebate system and for a lower scale of retail prices, if inaugurated in the territory serviced by the Riggs Optical Company, spread to the East and other territories not served by them?

Further developments, if any, will be most interesting to observe.

Alan C. Woods.

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## SPANISH OPHTHALMOLOGICAL SOCIETY

War, the great destroyer, brings to a standstill many of the finest agencies for progress, both social and scientific. Particularly those countries which must carry on the struggle upon their own soil are so involved in the sheer struggle for existence that they can find few or no op-

portunities for the refinements of civilized life.

The science and art of medicine suffer in common with other agencies for study and research. We in the United States have so far felt the scourge in smaller degree than any other great country concerned. But there is a tendency for important medical societies to suspend their meetings or to reduce the length of those meetings. Essential workers in great institutions have left for service with the armed forces. Medical journals have fewer readers, fewer scientific contributors, and therefore reduced opportunities for service. The exchange of journals and ideas between hostile countries is abolished "for the duration."

Particularly destructive of normal living is the tragic type of warfare which we call "civil war," implying warfare between citizens of the same country. When, in 1936, the forces of Franco opened their campaign against the popularly elected government of Spain, the Sociedad Oftalmologica Hispano-Americana had for thirty-two years played a distinguished part in the development of national and international ophthalmology. Founded in Madrid in 1904, it had held its first eight annual gatherings in that great city; and one of the resolutions adopted at the "Asamblea" held in 1904 in Palma, the capital of the Balearic Islands, declared the intention of holding the next Congress in Madrid, in September, 1936.

In the words of its present secretary, López Enríquez, "Two months before that date, with the labors of organization already well developed, the Glorious National Movement broke out, and it was impossible to meet again until" October 6, 1941.

The inactivity of this important scientific society (and, no doubt, of others equally important in their respective

fields) lasted not merely for the period of the civil war, but several years after peace was restored in Spain. The reason for this was apparently a fear on the part of the Falangist government that any large formal gathering, or the activities of any organization not strictly under the supervision of the government, might have mischievous consequences for national stability. The permanent administrative council of the Sociedad Oftalmologica could do nothing beyond guarding the funds of the society. Repeated applications to the government for permission to call a meeting met with refusal. "Considering the international character of the Sociedad, the society's executives were told, and in view of existing circumstances, it was proper to delay the convocation to a later date."

The nineteenth congress of the society was held in Madrid under the presidency of Dr. D. Alejandro Palomar de la Torre. The difficulties of organization encountered by the secretary, Dr. López Enríquez, included an actual lack of information concerning the majority of the members who had been listed before the civil war. The president's short address took notice of the fact that a good many distinguished foreign and national members had died since the gathering of the year 1934. No mention was made officially of some other members who, we may suppose, had gone into voluntary exile from their native land.

To the reader of the society's transactions, the urgent character of the government's refusal to permit an earlier reunion is emphasized by the following quotation from the president's address: "I appreciate that it is a duty of justice . . . to make mention of the spirit of sacrifice, disinterestedness, love of fatherland, and Christian charity, on the part of almost all Spanish ophthalmologists, from the beginning of the Glorious Move-

ment, both those whom it happened to find in the liberated zone, and those who had to carry on, and did it worthily, in the red zone."

Further reference is made to colleagues who, "at the risk of their lives and those of their families, fled from the red zone to take refuge in the liberated zone or placed themselves from the very beginning at the service of the common cause;" and also to the activities of some colleagues who, "having succeeded in escaping from the red zone, and being unable to assemble at an early date in liberated Spain, . . . held high the national banner and professional prestige in foreign countries."

It may too readily be feared that past events have not insured Spain against further fratricidal troubles. But we may rejoice that most of our Spanish colleagues are reunited for scientific activity. The twentieth congress of the Sociedad Hispano-Americana was held in Barcelona in September, 1942. Excellent programs were presented at both annual meetings, and the essays and addresses summarized, together with discussions, are well recorded in the new "Archivos de la Sociedad Oftalmologica Hispano-Americana." This journal, well printed and well edited, appears every month or two. It contains, in addition to the transactions of the annual meetings, a large number of original papers, and some abstracts from the foreign literature.

Among the original papers of the past year and a half are the following: by Leoz Ortín, Ocular phenomena of starvation (already noticed in this Journal); by J. Arjona, Subconjunctival autohemotherapy; by H. Arruga, Corneal transplants from cadaver cornea, and Finding and localizing detachments of the retina; by A. Moreu, Considerations on the ophthalmologic diagnosis of hypophyseal tumors; by A. García Miranda, Avitaminosis in ophthalmology; by M. López Enríquez, Amblyopia of starvation in the

alcohol-tobacco group; by J. Sellas Garriga, A case of retinal angiomatosis; by Palomar de la Torre and Palomar Palomar, Concerning the etiology of recurrent juvenile hemorrhages in the vitreous; and by N. Belmonte González, Residual astigmatism in the different ametropias.

W. H. Crisp.

### THE LESLIE DANA MEDAL

Last October 17th, the eighteenth award of the Leslie Dana Medal was made. At a well-attended dinner at the Coronado Hotel in Saint Louis, Dr. Walter B. Lancaster became the recipient of this honor. He discussed "The pathetic cases of blindness with good visual acuity." This



Leslie Dana medal.

was an excellent address from the broad-minded viewpoint that we have learned to expect from this man. He is one of those having vision as well as good visual acuity. A man so endowed dares to be a jump ahead of the laboratory, but this is dangerous for those not having critical minds and sound judgment based on long experience.

Father Schwitalla, dean of the Saint Louis University Medical School, presided at the dinner, at which guest speakers were Drs. S. Judd Beach and Everett Goar and Mr. Lewis H. Carris, director emeritus of the National Society for the Prevention of Blindness.

A brief history of this medal may be



of interest. The endowment for the medal was given to the Missouri Association for the Blind by Mr. Leslie Dana in 1925. The trophy itself is a beautiful gold medallion designed by the noted Boston sculptor, Christian Peterson.

The award is to be made annually, based on the following considerations:

a. Long meritorious service for the conservation of vision in prevention and cure of diseases dangerous to the eyesight.

b. Research and instructions in ophthalmology and allied subjects.

c. Social service for the control of eye diseases.

d. Special discoveries in the domain of general science or medicine of exceptional importance in conservation of vision.

The procedure for selecting the winner of the medal is as follows:

The National Society for the Prevention of Blindness will canvass the ophthalmic departments of university medical schools and various other groups interested in prevention of blindness during January and February each year. From the names thus proposed the National Society staff will select a list of not less than three nor more than six persons as nominees for the Dana Medal for the ensuing year. They will also prepare a short biographic sketch for each nominee emphasizing the reason for the selection. As soon as this list of nominees is approved by the Saint Louis Society for the Blind it will be forwarded to the Association for Research in Ophthalmology, Inc., probably before April 1st. The Association for Research in Ophthalmology, Inc., can then send the list to each of its trustees asking them simply to vote one—two—three—and so on, and the person receiving the smallest total vote will receive the medal for the ensuing year. Time and place for the presentation are to be arranged by the Saint Louis Society for the Blind.

Previous recipients of the medal are: Dr. Edward Jackson, Denver, Colorado; Miss Louise Lee Schuyler, New York, New York; Dr. Lucien Howe, Buffalo, New York; Dr. Francis Park Lewis, Buffalo, New York; Dr. Ernst Fuchs, Vienna, Austria; Dr. George Edmund de Schweinitz, Philadelphia, Pennsylvania; Mr. Edward M. Van Cleve, New York, New York; Dr. William Henry Luedde, Saint Louis, Missouri; Dr. Felix de Lapersonne, Paris, France; Dr. William Hamlin Wilder, Chicago, Illinois; Dr. John M. Wheeler, New York, New York; Mrs. Winifred Hathaway, New York, New York; Dr. Ellice M. Alger, New York, New York; Dr. Edward Coleman Ellett, Memphis, Tennessee; Mr. John M. Glenn, New York, New York; Dr. Arnold H. Knapp, New York, New York; Mr. Lewis H. Carris, New York, New York.

The distinguished names on this list indicate the good judgment of those who have selected the recipients and their acceptance the honor in which the award is held.

Awards of this character are stimulating to the profession, and this is properly regarded as one of the most desirable.

Lawrence T. Post.

## BOOK NOTICE

THE HUMAN EYE IN ANATOMICAL TRANSPARENCIES. By Peter Kronfield, M.D., Gladys McHugh, and Stephen Polyak, M.D. 99 pages, 34 color paintings. Rochester, N.Y., Bausch and Lomb Optical Company, 1943. Price \$6.50.

Here is a volume which comes closer successfully to achieving the goal of a worthy "atlas" of the gross anatomy of eye and orbit than any previous book on the subject. The treatise is divided into three sections. The first consists of a series of 34 colored paintings by Gladys

McHugh. These are paintings of gross anatomic dissections, done on transparent acetate at twice natural size, so that they represent a series of dissections progressing layer by layer through the eye and orbit—in front view and side view.

The accuracy of these pictures is of a high quality, and the artist has succeeded in emphasizing the different important structures in each picture. This characteristic renders the pictures excellent for the student, directly or as an aid to dissection. Each figure is accompanied by a short description of the region shown and of its chief structures.

It is somewhat difficult for the beginner to understand the topographic relations of some of the structures of the eye without the aid of sagittal sections and diagrams—for example, the relationship of orbital septum, orbicularis, levator palpebrae, and Müller's muscle—and, therefore, this volume cannot be a self-sufficient instrument for learning gross ocular anatomy. Likewise, the topographic anatomy of the lacrimal sac and nasolacrimal duct, as well as the anatomy of the zonular region, cannot be grasped readily in layer-by-layer pictures.

However, the second section of the book, an explanatory text by Dr. Peter Kronfeld, aids greatly in the elucidation of some of these more difficult phases. This text contains a systematic description, aided by black-and-white drawings, and then a topographic description, following closely the series of paintings. This portion of the book is clear, concise, and is not overburdened with the mass of mathematical data common to most anatomy texts.

The third section of the book, written by Dr. Stephen Polyak, contains a review of the history of knowledge of ocular anatomy. This makes absorbing reading, and it will undoubtedly be difficult for some readers to transport themselves

abruptly from a mass of very material, pictorial facts to the less concrete realm of historical study.

The book is heavily bound with leatherette cover. There is no advertising matter.  
Benjamin Milder.

## CORRESPONDENCE

### ON CONVERGENCE TESTS

Nov. 13, 1943

Editor, American Journal of Ophthalmology.

I have received several inquiries referring to my article "On convergence tests," in the September, 1943, issue, asking if the angle of convergence could not be calculated, at least approximately, with reference to the Pd and without the use of trigonometric tables. The answer to this is *yes*, it can be found and with a high degree of accuracy by the radian method as follows:

Measure the Pd (interpupillary distance) and the Pcb (near point of convergence from spectacle plane—then add 25 mm.). If we call X the angle between the two visual axes at the near point of convergence, then the proportion is Pd is to Pcb as angle X is to 57.3 (57.3 degrees is the value of the radian angle). Put in

form of an equation  $\frac{Pd}{Pcb} = \frac{X}{57.3}$ . Say

the Pd is 62 mm., the Pcb is 95 m.

then the equation is  $\frac{62}{95} = \frac{X}{57.3}$  whence

$X = 37.4^\circ$  or  $37^\circ 24'$ . By the sine tables the value comes out  $38^\circ 5'$ . This differs by less than three fourths of one degree from the finding by the radian method. In percentage form the difference is less than 2 percent and is well within the error incident to measurements at very close range.

(Signed) Joseph I. Pascal.

# ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

## CLASSIFICATION

- |  |  |
|--|--|
| 1. General methods of diagnosis                        | 10. Retina and vitreous                                |
| 2. Therapeutics and operations                         | 11. Optic nerve and toxic amblyopias                   |
| 3. Physiologic optics, refraction, and color vision    | 12. Visual tracts and centers                          |
| 4. Ocular movements                                    | 13. Eyeball and orbit                                  |
| 5. Conjunctiva   | 14. Eyelids and lacrimal apparatus                     |
| 6. Cornea and sclera                                   | 15. Tumors   |
| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries   |
| 8. Glaucoma and ocular tension                         | 17. Systemic diseases and parasites                    |
| 9. Crystalline lens                                    | 18. Hygiene, sociology, education, and history         |
|  | 19. Anatomy, embryology, and comparative ophthalmology |

### 7

#### UVEAL TRACT, SYMPATHETIC DISEASE AND AQUEOUS HUMOR

Igersheimer, Joseph. Intraocular injection of sulfanilamide in a case of purulent iridocyclitis. *Amer. Jour. Ophth.*, 1943, v. 26, Oct., pp. 1045-1047. (References.)

Marback, H. A case of congenital aniridia. *Arquivos Brasileiros de Oft.*, 1942, v. 5, June, pp. 97-101.

The patient, a man aged twenty years, was the only male child of the family. He had five sisters, who were free from the defect. No record of such an anomaly could be obtained for any other member of the family in three generations. The characteristic facies included half-closed eyelids, a horizontal nystagmus, which increased in intensity with increased illumination or upon fixing either distant or near objects. The iris was entirely absent from both eyes. One half of each pupil was clear, the other half was occupied by a semiluxated lens. The right eye presented an opalescent opacity in the

lower portion of the cornea, invaded by some conjunctival vessels. The right dislocated lens was entirely opaque, its surface showing vacuoles of varying size. In the lower outer part of this lens there was a 5-mm. pigmented spot made up of deposits which were star-shaped and resembled those of remains of the pupillary membrane. A somewhat similar formation appeared at the seven-o'clock position. With +13.00 sphere each eye obtained vision of 1/6. The tension of each eye was normal. The left cornea had no opacity. The left lens resembled that of the right eye.

W. H. Crisp.

Scobee, R. G. Choroideremia. *Amer. Jour. Ophth.*, 1943, v. 26, Nov., pp. 1135-1143. (7 figures, references.)

### 8

#### GLAUCOMA AND OCULAR TENSION

Ackerman, W. G., and Allen, T. D. The treatment of hereditary glaucoma. *Illinois Med. Jour.*, 1942, v. 82, Oct., pp. 295-300.

From the reported genealogical tree

it can be seen that 6 of 14 descendants from the originally affected female ancestor, in three successive generations, had glaucoma. Two of these were male. The average age of all seven affected was 11.6 years, with a span from 7 to 15 years. There was no tendency to hydrophthalmos, and no evidence of alteration of depth of the anterior chamber, or of the presence of an enlarged lens. Myopia was found in two cases. The glaucoma was of the simple chronic type. As to treatment, intraocular tension responded poorly if at all to miotics alone. As to surgical procedure iridectomy and posterior sclerotomy were found ineffective. In one patient one goniotomy has been effective for the last 29 months in one eye, whereas in the other eye five goniotomies, two cyclodialyses, and a deep root iridectomy were without result, but one iridencleisis has since controlled the condition for 19 months. Two goniotomies performed a year apart on each eye of another member of the family have apparently sufficed for nine months to date. In another, one goniotomy on the right eye, performed 18 months ago, and two on the left eye, performed 18 and 6 months ago, have controlled the condition to date. In another member a single goniotomy of the left eye has controlled tension, fields, and vision for eight months to date. The technique of goniotomy and the aftercare are described in detail. The authors add that miotics are of value in maintaining lowered tension before and after surgery. Various types of visual defect are reported. Melchior Lombardo.

Gibson, G. G. Transscleral lacrimal canaliculus transplants. *Trans. Amer. Ophth. Soc.*, 1942, v. 40, pp. 499-515.

Sixteen experimental transplants of

a portion of the lacrimal canaliculus into the sclera of dog eyes are described in detail. This procedure was developed by the author with the immediate objective of investigating the various early steps in the establishment of an epithelial tube through the sclera with the hope of finding a type of filtration operation that might be added to the operative armamentarium in the control of glaucoma.

A very cautious evaluation of the procedure is presented. After due consideration of possible objections and pitfalls, the operation was tried on a patient with advanced glaucoma who had very little vision to lose. Marked reduction in intraocular tension was produced during the first three weeks. Later the external end of the canaliculus became closed by subconjunctival scar tissue and the tension returned to its preoperative level.

The author emphasizes that the work is still in the experimental stage, but he seems satisfied of the feasibility of the procedure after certain technical improvements are made and there has been further clinical trial. (5 illustrations.) David O. Harrington.

Knighton, W. S. Reoperations for glaucoma. *Arch. of Ophth.*, 1943, v. 30, Oct., pp. 499-504.

The return of hypertension after a glaucoma operation is of fairly frequent occurrence. In such cases, the surgeon has already selected and performed the operation that he considered the most likely to succeed. The failure of the operation to control pressure leaves him with a considerable handicap. After the operation the eye is in a less favorable state because of fibrosis, mechanical difficulties, physiologic changes and other, unknown, factors. Filtration operations that have failed

may occasionally be made to work by removing plugs of uveal or scleral tissue from the fistula. Failures in filtration that result from cicatrization of the conjunctiva do not respond to attempts to reestablish filtration by again dissecting the flap. Very careful study of the eye, including gonioscopic observation, is always indicated before reoperation is attempted.

John C. Long.

## 9

### CRYSTALLINE LENS

Burch, E. P. Safeguards in cataract surgery. *Jour. Florida Med. Assoc.*, 1943, v. 29, Jan., p. 307.

Burch describes his procedures for avoiding complications in cataract surgery. These include methods of anesthesia and akinesia, and the use of corneoscleral sutures with conjunctival apron for covering the section. Retrobulbar anesthesia is advised.

T. M. Shapira.

Courtney, R. H. Endophthalmitis with secondary glaucoma accompanying absorption of the crystalline lens. *Trans. Amer. Ophth. Soc.*, 1942, v. 40, pp. 355-369.

Seven cases are reported which suggest a hitherto unrecognized clinical entity: namely, a late endophthalmitis in one eye due to sensitivity to lens protein, the latter having resulted from an operation on the fellow eye some years previously. The author believes that spontaneous rupture of the lens capsule, found clinically in one case and histologically in another, is the causative factor. The patients showed hypersensitivity to lens protein and in two instances there was evidence of spontaneous rupture of the lens capsule. The cases reported exhibited the

following clinical picture: (1) marked ciliary injection; (2) heavy keratic precipitates of the epithelioid type, the precipitates occasionally being so numerous and so large as to coalesce and obscure any view of the interior of the eye; (3) markedly increased intraocular tension; (4) greatly increased sensitivity to lens protein; (5) unmistakable evidence of spontaneous rupture of the lens capsule. When it is clear that the endophthalmitis results from absorption of the lens cortex, the correct treatment is removal of the lens matter by operation, an intracapsular extraction being highly desirable. Failing this, the use of thorough irrigation of the anterior chamber is urged. In the author's cases, after removal of the lens from the eye all the foregoing signs of endophthalmitis and secondary glaucoma disappeared by the time of the first dressing, and convalescence was uneventful. (5 illustrations, references.)

David O. Harrington.

Moehle, Walter. The use of conjunctival flaps in cataract extraction. *Trans. Amer. Ophth. Soc.*, 1942, v. 40, pp. 527-546.

After a fairly comprehensive review of the history and literature of conjunctival flaps in cataract surgery, the author presents his own technique of extraction of the lens through a vertical conjunctival slit. He feels that this method embodies certain distinct advantages as follows: (1) The conjunctiva alone is undermined. (2) Unnecessary conjunctival bleeding is avoided by the direction of incision. (3) Keratome incision into the anterior chamber and enlargement of the incision with scissors is easily accomplished. (4) Suture control of the wound lips is easy. (5) Iris and lens capsule are easily accessible. (6) Eversion of the

cornea is impossible. (7) Prolapse of the iris is diminished in frequency. (8) There is less danger of vitreous loss. (9) Healing is accelerated and post-operative astigmatism is reduced.

All extractions were through keratome incision enlarged by scissors, with full iridectomy and extracapsular extraction. (One illustration, extensive statistical tables, bibliography.)

David O. Harrington.

## 10

### RETINA AND VITREOUS

Campos, Evaldo. **Neuroretinitis with macular star.** *Arquivos Brasileiros de Oft.*, 1942, v. 5, June, pp. 131-136.

This anomaly was observed in a boy of eleven years. The vision of the right eye was reduced to light perception, without light projection. The vision of the left eye was 1.5. From the fovea, spindle-shaped white lines ran out at perfectly regular intervals, like the spokes of a wheel. The total area involved was larger than the disc, including some edema. The disc was decidedly edematous, the vessels distended, especially the veins; and there were small hemorrhagic foci in the area of edema. The urine contained only slight traces of albumen and was otherwise practically normal. The author excludes a renal origin. There were physical stigmata of syphilis, and the author is disposed to attribute the ocular condition to this disease. (11 references.)  
W. H. Crisp.

Cross, A. G. **Angioma of the retina.** *Brit. Jour. Ophth.*, 1943, v. 17, Aug., pp. 372-373. (See Section 15, Tumors.)

Gaynon, I. E., and Asbury, M. K. **Ocular findings in a case of periarteritis nodosa.** *Amer. Jour. Ophth.*, 1943, v. Oct., pp. 1072-1076. (References.)

Kauffman, M. L. **Lipemia retinalis.** *Amer. Jour. Ophth.*, 1943, v. 26, Nov., pp. 1205-1208. (References.)

Marburg, Otto. **Inclusion bodies and late fate of ganglion cells in infantile amaurotic family idiocy.** *Arch. of Neurology and Psychiatry*, 1943, v. 49, May, p. 708. (See Section 17, Systemic diseases and parasites.)

## 11

### OPTIC NERVE AND TOXIC AMBLYOPIAS

Barrenechea, S., Contardo, R., Arentsen, J., and Jasmen, A. **Treatment of optic neuritis, retrobulbar or not, with nicotinic acid.** *Oftalmologia Ibero Americana*, 1943, v. 5, no. 1, pp. 7-21 (in Spanish) and 21-29 (in English).

The author treated five cases of optic neuritis with nicotinic acid. Four of the cases were retrobulbar. The dose used was 300 mg. daily. There was rapid improvement in central vision, visual fields, perception of colors, and subjective symptoms, within the first ten days of treatment. Each case is described in detail.

## 12

### VISUAL TRACTS AND CENTERS

Fralick, F. B. **The treatment of amblyopia.** *Amer. Jour. Ophth.*, 1943, v. 26, Nov., pp. 1195-1197.

Hughes, E. B. C. **Injury to the opticochiasmal junction.** *Brit. Jour. Ophth.*, 1943, v. 27, Aug., pp. 367-371.

In the case here reported there was injury in the left frontal region with a fracture of the left frontal bone, traversing the left frontal sinus, running along the floor of the left anterior fossa lateral to the optic canal, and then passing down into the left middle

fossa. The course of the fracture was verified in two operative procedures. No definite fracture into the left optic canal was demonstrated and no fracture of the left anterior clinoid process was demonstrable by X ray or at the time of operation. Two days after injury, a left epidural hematoma was exposed and removed through a temporal craniotomy. Postoperatively, there was severe loss of vision in the left eye and a partial third-nerve paresis. The right visual field was normal. The left visual field showed doubtful perception of light in the upper nasal field only.

A week after the operation, the patient had a clinical attack of meningitis, which lasted only a few days and responded rapidly to sulfapyridine. At this time the third-nerve paresis began to progress. It became complete thirteen days after injury. Visual acuity in the left eye had improved by this time to good counting of fingers in the upper nasal field only. The right field was passed as normal again. During the next few weeks the patient remained mentally confused, and a left frontal intracerebral aërocele was suspected and confirmed by X ray. It was not until ten weeks after the injury that the patient's condition was good enough to warrant full quantitative perimetry. A large island of vision in the upper nasal field was found on the left side, together with a little macular vision. Acuity was 1/60. In the right field, however, a large upper temporal quadrantic defect was found together with some depression in the lower temporal field. This field pattern remained stationary until the second operation, sixteen weeks after injury.

At operation, the posterior part of the anterior fossa was found to be the seat of massive adhesions extending back as far as the sphenoid ridge and

enveloping the intracranial part of the left optic nerve as far as the chiasmal junction. The chiasm itself appeared to be normal. The nerve was freed from its adhesions and the operation was terminated by drainage of the frontal cyst resulting from the aërocele.

There was a marked improvement in the patient's mental state postoperatively, and an equally startling and unexpected change took place in his visual fields. Vision in the left eye rapidly improved within fourteen days from 1/60 to 6/36. Perimetry showed this to be due to a general enlargement of the island of vision. The field in the right eye also improved until only a moderate-sized upper temporal scotoma remained.

The site of this patient's injury must have been either in the termination of the left nerve or in the anterior chiasmal angle. The lesion affected mainly the fibers of the left nerve but also caught the knee of crossed fibers from the lower nasal retina of the right eye. (Fields, references.)

Edna M. Reynolds.

Long, A. E. Amaurosis following nasal hemorrhage. *Amer. Jour. Ophth.*, 1943, v. 26, Nov., pp. 1179-1182. (References.)

Verhoeff, F. H. A new answer to the question of macular sparing. *Arch. of Ophth.*, 1943, v. 30, Oct., pp. 421-425.

The destruction of one optic tract results in splitting of the macula as detected by field tests. Apparent sparing of the macula occurs after complete destruction of one occipital lobe. This apparent sparing is explained by loss of integration between the seeing field and the blind field in the conscious visual cortical area in use. This loss results in the employment of an eccentric



retinal point for fixation and slipping of fixation occurs easily. The true macular field is actually split but field tests show it to be more or less spared.

Lesions of the optic tract do not disturb the integration between the seeing field and the blind field. In these lesions there is no eccentric fixation and splitting of the macula is therefore found in field tests. Even after complete destruction of one occipital lobe, macular splitting may be found if integration in the conscious visual area in use is not too greatly disturbed. The author states that this theory needs additional facts before it can be unreservedly accepted. John C. Long.

### 13

#### EYEBALL AND ORBIT

Courtney, R. H. **Endophthalmitis with secondary glaucoma accompanying absorption of the crystalline lens.** *Trans. Amer. Ophth. Soc.*, 1942, v. 40, pp. 355-369. (See Section 9, Crystalline lens.)

Dunnington, J. H. and Berke, R. N. **Exophthalmos due to chronic orbital myositis.** *Arch. of Ophth.*, 1943, v. 30, Oct., pp. 446-465.

Chronic orbital myositis has at times been described under the less desirable names of idiopathic myositis, Zeker's waxy degeneration, pseudotumor, and exophthalmic ophthalmoplegia. This condition is a nonspecific, chronic inflammatory disease of the extraocular muscles of unknown causation. Microscopic examination of the involved muscle shows lymphocytic infiltration, fibrosis, and degeneration of muscle fibers. The muscles are enlarged, pale, and cartilaginous. The disease is relatively painless unless keratitis results from exposure. There is edema of the lids, moderate to severe exophthalmos, and marked diplopia. There is distinct

limitation of motion of the eyeball, especially upward, and inelasticity of the affected muscles. The limitation of motion is best demonstrated by grasping the anesthetized eye with forceps. Strong resistance is encountered when an attempt is made to stretch the involved muscles.

There is no recognized form of treatment for chronic orbital myositis. Surgery is to be avoided if the correct diagnosis can be made, as the condition is practically always rendered worse by surgery. Radiation is not of value. The prognosis for spontaneous recovery is good if surgery is not undertaken. Treatment should be directed toward preservation of the cornea.

The authors report four cases of chronic orbital myositis. All of these patients were operated upon. A detailed pathological report on the tissues is given. All but one of the patients showed severe permanent limitation of motion. (Bibliography.)

John C. Long.

Snow, W. J. **Orbital complications in suppurative sinus disease.** *Texas State Jour. Med.*, 1943, v. 38, Jan., p. 557.

The author describes five cases with swollen lids, conjunctival edema, proptosis, displacement and fixation of the globe, and a history of recent onset. These cases were not treated uniformly, but the author is convinced that early surgery is desirable. He believes that the external ethmoidal approach affords good exposure and good drainage with a minimum of surgery. He is also of the opinion that classical operations on the sinuses should be avoided during the fulminating stage of these infections. T. M. Shapira.

Verhoeff, F. H. **Improved technique for implantation of a ball in Tenon's capsule.** *Amer. Jour. Ophth.*, 1943, v. 26, Oct., pp. 1057-1061. (References.)

## 14

## EYELIDS AND LACRIMAL APPARATUS

Ellis, O. H. A combined ptosis operation. *Amer. Jour. Ophth.*, 1943, v. 26, Oct., pp. 1048-1052; also *Trans. Pacific Coast Oto-Ophth. Soc.*, 1942, 30th mtg. (5 drawings, references.)

Paula Xavier, J. de. Blepharitis and pyococci. *Rev. Med. do Paraná*, 1943, Jan., abstracted in *Arquivos Brasileiros de Oft.*, 1943, v. 6, April, pp. 39-42.

The generic denomination of pyococci includes various substances derived from anilin, endowed with cicatrizing and antiseptic qualities, without being toxic or irritating. Examples are methylene violet, auramin, methylene green, and methylene blue. The drug is used in the form of a pencil mounted in a small wooden case. Van Lint and others have advised cleaning the ciliary margin with benzine in order to remove all greasiness, then passing the pencil, moistened in 40-percent alcohol, along the roots of the lashes. The application is made every second day. The author's cases showed no example of intolerance. Any objectionable staining of the lids can be disguised by the use of tinted glasses. Failures are attributed to inadequate care as to cleansing of the lid margins. (Abstract in Portuguese by W. Belfort Mattos.)

Potter, W. B. Bilateral congenital coloboma of upper lids. *Amer. Jour. Ophth.*, 1943, v. 26, Oct., pp. 1087-1089. (One illustration, references.)

## 15

## TUMORS

Cross, A. G. Angioma of the retina. *Brit. Jour. Ophth.*, 1943, v. 27, Aug., pp. 372-373.

In the case of angiomatosis retinae now reported there was such rapid in-

crease in size within a week's time that a diagnosis of malignant growth was made and the eye was enucleated. It is probable that if the eye had not been removed retinal gliosis would have occurred, followed by complete degeneration of the eye. This case confirms the belief that angiomatous growth is the initial abnormality in cases of Hippel's disease. (One illustration, references.)

Edna M. Reynolds.

Ray, B. S., and McLean, J. M. Combined intracranial and orbital operation for retinoblastoma. *Arch. of Ophth.*, 1943, v. 30, Oct., pp. 437-445.

Extension of retinoblastoma into the optic nerve is a very common occurrence. It is believed that the standard operation of enucleation is inadequate in nearly 50 percent of cases of retinoblastoma. Exenteration of the orbit or secondary intracranial resection of the nerve is unsatisfactory. Irradiation of the stump of the optic nerve after enucleation has improved results but is not wholly satisfactory.

As the most complete method of removing the tumor, the authors propose intracranial resection of the optic nerve followed by enucleation. The intracranial operation is performed through an incision like that routinely employed by the neurosurgeons in the "hypophyseal approach". The nerve is cut at the chiasm and at the optic foramen and is removed. The optic foramen is coagulated by the electrosurgical unit and then plugged with a piece of temporal muscle. Twelve to thirteen days later the eye is enucleated. The remainder of the optic nerve is removed by traction. The intracranial operation is relatively safe and is well tolerated even by infants.

It is safer to do the intracranial operation before enucleation, because it is then more certain of removing all of

the nerve and there is less danger of intracranial infection. The chief disadvantage is that in approximately 50 percent of the cases the intracranial operation is unnecessary, as enucleation shows that the nerve was not involved. The authors report the cases of two patients treated by the two-stage operation. Both patients stood the surgery very well.

John C. Long.

## 16

### INJURIES

Alvis, E. O. Wartime-patient phase of industrial ophthalmology. *Jour. Indiana State Med. Assoc.*, 1943, v. 36, May, p. 235.

Though statistics on the comparative increase of eye injuries since war production has been speeded up are not available, the author from his own experience feels that there has been an increase in the number of industrial eye injuries. Their number can be reduced by proper education, coöperation between employer and employee, and ample provision for making a plant physically safe. Guards, goggles, shields, and other protective devices are absolutely essential. Fluorescent lighting is considered unfavorable from a safety standpoint.

Injuries from emery, tool particles, chemicals, and actinic rays are discussed and suggestions given. Early antiseptic care of eye injuries is highly stressed. The employee is warned against the self-appointed "foreign body remover," usually a fellow employee with no regard for asepsis and whose manipulations at times end disastrously.

Francis M. Crage.

Beil, W. C. Closure of the sclera after removal of intraocular foreign body by

the posterior route. *Amer. Jour. Ophth.*, 1943, v. 26, Nov., pp. 1210-1211,

Belfort Mattos, W. A cilium twenty years in the anterior chamber. *Arquivos Brasileiros de Oft.*, 1943, v. 6, April, pp. 38-39.

The patient, a man of 28 years, had received an injury to the right eye at the age of eight years. There was a small central leucoma of the cornea. From the center of the leucoma a filament, not unlike those seen in remains of the pupillary membrane, proceeded toward the iris. With movements of the iris, the filament became displaced on the anterior surface of that structure. There was no pericorneal injection or other anomaly. It was found impossible to seize the filament through a small opening at the edge of the cornea, but expulsion was obtained by somewhat forcible lavage. (One illustration.)

W. H. Crisp.

Clark, W. B. Procedures and appliances that are helpful in treating industrial ocular injuries. *Amer. Jour. Ophth.*, 1943, v. 26, Oct., pp. 1054-1057. (2 illustrations.)

Cordes, F. C. Nonsurgical aspect of ocular war injuries. *Amer. Jour. Ophth.*, 1943, v. 26, Oct., pp. 1062-1071. (References.)

Kilgore, G. L. An experimental study of iridodialysis. *Trans. Amer. Ophth. Soc.*, 1942, v. 40, pp. 516-526.

An experimental study of the mechanism of production, the early and late clinical picture, and the prognosis of iridodialysis produced by trauma is presented.

The author concludes that iridodialysis may be produced by sudden blows on the corneal surface at or anterior to the corneoscleral limbus. The iris is

not readily torn by contusions wherein the force radiates slowly from the point of injury. Considerable damage to the intraocular tissues is associated with traumatic iridodialysis. The intraocular pathology of iridodialysis cannot be determined by the usual methods of eye examination, and a guarded prognosis should be given in such cases. (16 illustrations, references.)

David O. Harrington.

Kolen, A. A. **Soviet military ophthalmology.** *Lancet*, 1943, v. 244, June 26, p. 804.

When war broke out, base hospitals throughout the Soviet Union were equipped with X-ray apparatus and giant electromagnets. Ophthalmologists were grouped with otolaryngologists and stomatologists in order to combine the treatment of face wounds in general. The ophthalmic service was so efficient that large numbers of the ocular casualties were speedily returned to the ranks and the labor front.

For years past the clinic at Novosibirsk has paid especial attention to plastic operations. Several highly satisfactory procedures are described by Kolen, including reconstruction of the conjunctival sac without grafting of new tissue, but by stretching shrivelled surfaces, adapting a prothesis, and allowing the conjunctival tissue to proliferate so as eventually to cover the whole affected area without secondary shrinkage.

In wounds involving the orbital borders, scars can be separated, dissected out, and the gap filled with a pedicled flap taken from the adjacent subcutaneous cellular tissue. Such flaps readily became engrafted, and, without shrinking, afford excellent cosmetic results. Defects of mucous membrane of the lids, with adhesions, are repaired

by what the author calls the "transplantation flap-method" which consists of implanting upon the raw surfaces strips of mucous membrane from the lips. In reconstructing eyelids a "flap-pocket" is employed, consisting in the planting of strips of lip membrane in a pocket beneath healthy adjacent skin and, later, intercalating a slice of ear cartilage between the skin and the membrane; as a final step, all components (skin, cartilage, and mucous membrane) are transplanted by pedicle, giving in effect a ready-made lid.

Whereas surgeons have commonly deemed it wise to wait until shrinking was complete, a process frequently consuming months or years, in wartime such delays cannot be allowed. Moscow surgeons operate soon after the receipt of injuries, especially when uncomplicated by fracture or extensive suppuration; and they obtain good results even as early as two to four months after injuries are received.

Contracted scars in the temporal region adhering to the bone are likely to involve the meninges. For these and those invading the deep nasal area, where fistula or other complications might follow, special care is taken in all transplanting and the adjusting of pedicled flaps.

At the Novosibirsk clinic segments of the ciliary body have been excised, and the author cites an instance in which a ciliary sarcoma was removed without loss of sight to the affected eye. War-time successes in the same field suggest the foundation of a new operative sphere in the eye—surgery of the ciliary body.

Burton Chance.

## 17

### SYSTEMIC DISEASES AND PARASITES

Abreu Fialho, Sylvio. *Cysticercus cellulosae* in the anterior chamber. Ar-

quivos Brasileiros de Oft., 1942, v. 5, June, p. 142. (Abstract from O Hospital, 1942, v. 21, no. 5, May.)

The original article related a case of cysticercus in the anterior chamber, with references to the national medical literature of Brazil, which records only three cases. In the case now reported, the cysticercus was in the inner part of the angle of the anterior chamber, with adhesions to the iris. Operation consisted of simple incision at the limbus above. The diagnosis was confirmed by laboratory examination. The larva was dead and the cyst calcified. The eye retained vision of 1/10.

(Abstract in Portuguese  
by Alfredo Rocco.)

Constantine, E. F. Tuberos sclerosis. Arch. of Ophth., 1943, v. 30, Oct., pp. 494-498.

Tuberos sclerosis is a clinical entity characterized by adenoma sebaceum, convulsions, mental deficiency, and fundus lesions. The author observed this condition in a ten-year-old boy. The boy had been normal until six months of age at which time generalized twitching developed and it was noticed that he was cross-eyed. He had had several attacks diagnosed as encephalitis, and numerous generalized convulsions. He did very poorly in school and was not coöperative. On examination typical adenoma sebaceum of the face was found. There was a convergent strabismus. The vision of the right eye was 20/20-2 and of the left eye 20/400 eccentrically. The right fundus showed a large flat whitish area below the disc and a smaller similar area above the disc in which there were a few cysts. The left fundus showed three tremendous cystic swellings, one on the disc and one above and below the macula. Roentgenograms of the

skull showed several calcified areas, probably in the choroidal plexus. An electroencephalogram was suggestive of a neoplasm.

John C. Long.

Edgerton, A. E. Herpes zoster ophthalmicus. Trans. Amer. Ophth. Soc., 1942, v. 40, pp. 390-439.

This exhaustive treatise on the subject of herpes zoster ophthalmicus reviews the literature of the subject, including the history of the disease. The present status of the subject is outlined under the following headings: anatomy, age, sex, seasonal occurrence, exposure, prodromal symptoms, pain, vesicles, lymphatic glands, eyelids, conjunctiva, ocular complications, corneal anesthesia, cornea, intraocular tension, iris, sclera, nasal nerve, lacrimal nerve, facial nerve, sympathetic disturbances, Argyll Robertson pupil, sympathetic ophthalmia, exophthalmos, muscle paralysis, third nerve, third, fourth, and sixth nerves, bilateral cases, recurrent cases, optic-nerve involvement, other nerve involvement, types (epidemic and symptomatic), chicken pox, herpes simplex, pathology, optic nerve, retina and choroid, glaucoma, adjoining ganglia, spinal fluid and blood, prognosis, diagnosis, treatment, and conclusions.

The author reports his own cases and his experiences in diagnosis and treatment. In conclusion he presents a statistical analysis of the composite clinical and pathologic picture as gleaned from the literature. (Extensive bibliography.)

David O. Harrington.

Magalhães, Octavio de. Scorpionism and visual apparatus. Arquivos Brasileiros de Oft., 1942, v. 5, June, pp. 141-142. (Abstract from O Hospital, 1942, v. 21, no. 5, May.)

The article is a survey of the action of this poison upon animals and man,

from the point of view of the eye. In mild cases there are no changes in the visual apparatus, but in severe or medium cases the ocular changes are marked. They may include changes in neuromotor control, inducing nystagmus, convergent strabismus, palpebral ptosis, conjugate deviation of the eyes and the head, and disturbances of the intrinsic musculature of the eye in the form of mydriasis or miosis; sensory disturbances in the form of blindness or diminution of vision; and finally disturbances of the vascular and secretory apparatus of the eye, with lacrimation, bluish coloring of the sclera, and retinal hemorrhages.

Animal experiments are recorded. The author also reports a case of poisoning in a child of two years who had been stung by a scorpion. In this case, in spite of every attempt at treatment, including antiscorpionic serum, the child developed a generalized hypersecretion, accompanied later by blue coloring of the scleras and terminating in steady deterioration of the general condition, with acute pulmonary edema and death. The original article is said to contain a fairly abundant bibliography. (Abstract in Portuguese by Alfredo Rocco.)

Marburg, Otto. Inclusion bodies and late fate of ganglion cells in infantile amaurotic family idiocy. *Arch. of Neurology and Psychiatry*, 1943, v. 49, May, p. 708.

The author investigated the pathologic changes in infantile amaurotic family idiocy. He discovered the existence of inclusion bodies as well as severe secondary cell changes. The inclusion bodies are partly argentophilic and partly argentophobic, depending on the kind of fat which forms their basis. They are usually associated with con-

vulsive states, or myoclonia. According to their origin the inclusion bodies may be differentiated into three types. One type is derived from fat, another type from changes in the axons and fibrils, and the third type is formed by nuclear excretion. Only the first two types are associated with amaurotic family idiocy, and only they can be considered as evidence of degenerative metabolic processes, while the third type is seen in infectious diseases.

Every ganglion cell has a functioning part, the fibrils, and a vegetative part, the cell plasma. In amaurotic family idiocy the fibrils remain for a long time intact, and the severe changes in the plasma may produce few clinical signs and symptoms. Only in diseases of longer duration, when the fibrils, too, become deranged, do we find corresponding severe clinical signs. The atonic asthenia is due to cholinergic and adrenergic factors, obviously the result of changes in the thymus and the adrenals. It is similar to the asthenia found in myasthenia and in Addison's disease. R. Grunfeld.

Paulo, A., Jr. Ophthalmopathies of tuberculous nature. *Arquivos Brasileiros de Oft.*, 1942, v. 5, June, pp. 101-117.

This is an inaugural address delivered in the Escola Paulista de Medicina. It reviews the general subject of ocular tuberculosis, with numerous references to the literature, and with special discussion of phlyctenulosis, hemorrhage into the vitreous, and the disease known as Boeck's sarcoid. Of the last condition the author cites an individual case, in a woman of 45 years. There were deep orbital pains on the right side, which were said to have existed since sudden loss of vision some time previously. The left eye had tem-

porary obcurations of vision, and showed a 50-percent loss of visual acuity. There were nodules in the eyelids, in the frontal region, in the ala of the nose, and in the right malar region. After a month of treatment with tuberculin, all the subcutaneous nodules underwent absorption. In the course of a year glaucoma developed in each eye, and antiglaucomatous sclerectomies were performed. The right eye retained its vision, but the left eye became entirely blind. W. H. Crisp.

## 18

HYGIENE, SOCIOLOGY, EDUCATION,  
AND HISTORY

Belfort Mattos, W. Need for medical syndicalism among the oculists. *Arquivos Brasileiros de Oft.*, 1942, v. 5, June, pp. 137-141.

This address, delivered upon taking over the presidency of the Ophthalmological Society of São Paulo, Brazil, talks very frankly of the inadequacy of the economic status of ophthalmology in Brazil. In that country there are not more than 800 ophthalmologists for a population of about 40 million. Although the Brazilian law requires syndicalization (a sort of trade union development) of physicians, the ophthalmologists are said to make little use of this means of coördinated effort. The author complains that, in the very proper desire of obtaining a good clientele and good economic standing, the new oculist, like other young physicians, seeks the poorly remunerative work of so-called benefit societies, or of insurance companies, or sacrifices all his mornings to the advantage of those exploiters of medical services, the charity clinics. The young oculist argues that he is there to learn and practice, forgetting that in all professions the apprentice also is paid for his work.

Frequently he works for an older colleague. He begins to run hither and thither in an automobile bought on "easy payments", to appear in medical gatherings and take part in discussions and dinners, and competes for the post of junior helper to the junior assistant in a charitable institution, in order to be able to use that position as an advertisement at the head of his prescription blanks, which he gets printed by some drug concern. The oculist neglects the smaller communities, preferring to remain in the large cities.

These and many other things Belfort Mattos says in order to demonstrate that within the Ophthalmological Society of São Paulo, side by side with the study and development of Brazilian ophthalmology, ophthalmologists can and should strive for a better economic and social condition of their specialty.

W. H. Crisp.

Chance, Burton. A survey of the state of ophthalmology in Philadelphia at the time of the founding of the Section on Ophthalmology at the College of Physicians. *Amer. Jour. Ophth.*, 1943, v. 26, Nov., pp. 1164-1170.

De Brito Conde, Herminio. Inaugural address of the course on ocular hygiene. *Arquivos Brasileiros de Oft.*, 1942, v. 5, June, pp. 117-130.

The author, who is General Secretary of the Brazilian National League for the Prevention of Blindness, delivered the opening address in a series organized by the Brazilian General Secretariat of Health and Assistance. He insists on the need for an ocular conscience, cites from the literature classical examples of the influence of visual disturbance upon the career of the individual (especially with regard to an author named Machado de Assis), and



supports the belief that continuous near work may induce or aggravate pathological ocular conditions.

W. H. Crisp.

Lowenfeld, Berhold. Partially seeing children in schools for the blind. *Outlook for the Blind*, 1942, v. 36, Dec., p. 287.

This article is a survey of the admission requirements of partially seeing children for admission into schools for the blind. Legal requirements with regard to amount of vision are given and also the amounts of vision actually recognized for admission into various schools. Questionnaires returned by the schools furnished the information.

In most states a definite specification in regard to the amount of vision is not included in the legal requirements for admission. In 88 percent of the schools it is found impossible to adhere to a strict definition of blindness in dealing with admissions. The author explains the factors which cause requirements to vary.

Francis M. Crage.

Norris, M. A. Review of cases admitted on the eye service at the Riley Hospital from 1936 to 1942. *Jour. Indiana State Med. Assoc.*, 1942, v. 36, May, p. 239.

The cases admitted to the hospital during this six-year period included 114 congenital anomalies, 54 injuries, five retinal detachments, 126 inflammatory conditions, 15 tumors, and 212 cases of strabismus. In the reviews are noted the important findings, ideal aims, and the general treatment employed in some of the cases.

Francis M. Crage.

Oak, Lura. The Massachusetts vision test, an improved method for school vision testing. *Amer. Jour. Pub-*

*lic Health etc.*, 1942, v. 32, Oct., pp. 1105-1109. See Section 1, General methods of diagnosis.

Sloane, A. E., and Gallagher, J. R. A summary of findings at the eye examination of preparatory-school boys. *Amer. Jour. Ophth.*, 1943, v. 26, Oct., pp. 1076-1083. (4 tables, references.)

Woods, A. C. The story of the Red Cross Institute for the Blind (1918-1925) in relation to the present problem of the war-blinded. *Amer. Jour. Ophth.*, 1943, v. 26, Oct., pp. 1011-1024. (References.)

## 19

### ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Browman, L. G., and Ramsey, F. Embryology of microphthalmos in *rattus norvegicus*. *Arch. of Ophth.*, 1943, v. 30, Sept., pp. 338-351.

There are a number of influences which affect and arrest the eye in its embryonic growth: for example, mechanical injuries, or abnormal pressures; infections, toxicoses, vitamin or other nutritional deficiencies, metabolic and endocrine disturbances in the mother ante partum, and interference with the blood supply to the embryo or to the developing primordia. Certain abnormalities of the eye have been shown to be inherited.

In order to study the heredity, the authors started with a female rat with bilateral microphthalmos and mated her with a normal-eyed litter mate; one microphthalmic animal appeared. Brother-sister matings of this strain were continued in an attempt to increase the proportion of small-eyed animals.

The average percentage of microphthalmic rats increased from a low of 19

to over 85 in the seventh generation. It is of interest to note that no litter in which all animals had some degree of microphthalmos was observed until the seventh generation. In this generation 7 of 20 females produced litters in which all of the young exhibited some degree of microphthalmos. In the present investigation 22 sixth-generation microphthalmic females were used to obtain 51 embryos and fetuses.

The development of the normal eye in a series of embryos from the microphthalmic females was followed from the optic-vesicle stage to the stage just before delivery. A table of this development is given. Only two brain anomalies associated with microphthalmos were observed. Autopsy disclosed that the optic nerves were missing in 19 of 48 adult rats with apparently normal-sized eyes, and with no opacities or other abnormalities. The peculiar association of absence of the hyaloid artery with a well-developed annular blood supply probably accounts for the appearance of a normal eyeball without an optic nerve.

In none of the 10.5-to-12-day-old embryos studied did the optic vesicle and the optic cup reveal abnormalities. It would therefore seem that the critical

period in the formation of microphthalmos in this strain of rats is at the time of formation of the embryonic blood supply to the eye, namely, at 12 to 13 days. Other structures in the eye and orbit were also involved. (8 figures, 35 references.)

Ralph W. Danielson.

Gregory, P. W., Mead, S. W., and Regan, W. M. A congenital hereditary eye defect of cattle. *Jour. of Heredity*, 1943, v. 34, April, p. 125.

Inbreeding experiments with Jersey cows, designed to fix the factors for high milk and butterfat production, have brought out a recessive change in the form of a congenital type of cataract. This was found in pure-bred Jerseys at the University of California. The lenses were smaller than normal and were dislocated. Ophthalmologic studies made included microscopic sectioning of affected eyes.

Francis M. Crage.

Sverdlick, José. Observations on the structure of the retinal cells. *Arch. de Histologia Normal y Patologica*, 1943, v. 1, March, 13 pp. (See Section 10, Retina and vitreous.)

# PAN-AMERICAN NOTES

Edited by DR. M. URIBE TRONCOSO  
500 West End Avenue, New York

Communications should reach the Editor by the twelfth of the month

## MISCELLANEOUS

**ARGENTINA.** The Argentine Committee for the Prevention of Blindness and Trachoma has appointed the following physicians to the Board of Directors for 1943-1944: Dr. J. Lijo Pavia, president; Pio Pandolfo, first vice-president; Enrique Monchet, second vice-president; Carlos R. Porto, treasurer; Dudley S. Drabble and Buido S. Longoni, secretaries.

*The Argentine Ophthalmological Society* held a theoretical-practical course on strabismus under the supervision of Dr. Jorge Malbran. The course consisted of a series of five lectures held at the Argentine Medical Association and three surgical demonstrations held in the Santa Lucia Ophthalmic Hospital. The subjects included in the course were: Mechanics of ocular movements; Binocular vision; Fusion; Disturbances of muscular equilibrium; Latent strabismus or heterophorias; Vision of the patient with strabismus; Etiopathogeny of strabismus; Convergent and divergent strabismus; Oblique strabismus; Treatment of strabismus; Paralysis of the extrinsic muscles of the eye; Paralysis of the third pair of supranuclear paralyzes.

**BRAZIL.** The Ophthalmic Board of Examination in Brazil (Consellio Nacional de Oftalmologia) has awarded certificates of proficiency to nearly 150 physicians in all the territory of Brazil.

*Permanent postgraduate course for ophthalmologists.* After holding postgraduate courses for seven years which have been fairly well attended by physicians from São Paulo, the interior, and even from neighboring countries, the Ophthalmological Clinic of the Escola Paulista de Medicina instituted the first permanent postgraduate course for ophthalmologists in June of the year 1943. The course will be so arranged that students can begin practical ophthalmology after concluding their studies. The lectures will be given in the presence of patients in the large specialized centers, so that the student can take an active and immediate part in propedeutics and surgery, accompanied by theoretical explanations on diagnostic fundamentals and prognosis. Those who wish to take only part of the course may do so after arrangements have been made with the secretary. The course can be started by the student at any time, thus making it easier for visitors from the interior to make a profitable stay in São Paulo.

**MEXICO CITY.** The Hospital Infantil in Mexico City was opened to the public on May 29, 1943. This building is the second to be completed in the new Medical Center now under construction. The building is of concrete and has six floors, with a capacity of 550 beds for children of all ages, from newborn infants to children 14 years of age. There is an ophthalmologic department as well as departments of pediatrics, orthopedic surgery, and so forth. The unit will be used also as a teaching department for the medical school of the National University, and has lecture rooms, classrooms, and students' laboratories located in the building. The Hospital is under the direction of Dr. Federico Gomez, a prominent pediatrician, who has been interested for many years in the construction of a children's hospital in Mexico City.

In the September-October number of the Transactions of the American Academy of Ophthalmology and Otolaryngology, Dr. Harry S. Gradle has an article on the history of the Pan-American Congress of Ophthalmology since its inception in 1939 to the first meeting of the Congress in Cleveland, Ohio, on October 11 and 12, 1940. The meeting followed directly upon the close of the meetings of the Academy. The article ends with the enumeration of the 12 fellowships granted by the Kellogg Foundation, which in normal times will be allotted to the different countries as follows: Argentina, 4; Bolivia, 1; Brazil, 6; Chile, 2; Colombia, 1; Costa Rica, 2; Cuba, 2; Dominican Republic, 1; Ecuador, 1; El Salvador, 1; Guatemala, 2; Haiti, 1; Honduras, 2; Mexico, 2; Nicaragua, 1; Panama, 2; Paraguay, 1; Peru, 1; Puerto Rico, 1; Uruguay, 1; Venezuela, 1.

**GUATEMALA.** The Girl Guides help in the local sight-saving activities by teaching the Braille method and conducting a clinic for the blind. A free clinic, in charge of Dr. Pacheco Luna, is shortly to be opened in the Casa del Niño. The 800 children who attend that institution will have their eyes examined when they enter at the age of one year, and regularly thereafter until they leave at the age of seven years. Both of these institutions are supported by the International Association of Lions.

## SOCIETIES

*Second Pan-American Congress of Ophthalmology*

*mology*, scheduled to be held in Montevideo, Uruguay, November 4 to 9, 1943, has been postponed on account of conditions entailed by the war until the year 1944.

*Brasil.* Two ophthalmological societies have renewed their Board of Directors for 1943-1944. The Ophthalmological and Otolaryngological Society of Rio Grande do Sul elected Dr. J. G. Valentín, president; Dr. G. Torres, vice-president; Dr. Alfredo Schermann, first secretary; and Dr. J. P. Correa Soares, treasurer.

*The Brazilian Society of Ophthalmology*, Rio de Janeiro. At the December, 1942, meeting of the Society, the following papers were presented: Myopia due to the use of sulfanilamide, by Prof. Paulo Pimentel; A case of retinal changes in tuberous sclerosis, by Dr. Edilberto Campos.

*The São Paulo Ophthalmological Society.* The following papers were presented at the February, 1943, meeting: Therapeutic suggestions in three cases of uveitis, by Dr. Candido da Silva; (1) Anti-infectious action of the sulfanilamide drugs on the eyeball, and (2) Epidemic kerato-conjunctivitis and its actual im-

portance, by Dr. Moacyr E. Alvaro.

*Mexican Society of Ophthalmology and Otolaryngology.* At the September, 1943, meeting of this Society the following papers were presented: The problem of pupillary occlusion and its treatment, by Dr. H. Fernandez Isassi; The treatment of cancer of the larynx, by Dr. L. Vaquero.

#### PERSONALS

A number of students from Latin America are now studying ophthalmology in the United States for periods of six months to one year. Those known to the editor are: In New York—Drs. Ed. Garduña of Mexico, now at the New York Eye and Ear Infirmary; Drs. Scapini of Costa Rica, Vasquez of Paraguay, and Olmos of Mexico, at the Eye Institute of Columbia University; and Dr. Silva, in Chicago, at Dr. Gifford's clinic.

Dr. Conrad Berens, secretary of the International Congress of Ophthalmology, has been appointed to two new posts: Professor of clinical ophthalmology at Columbia University's College of Physicians and Surgeons, and Civilian consultant in ophthalmology to the Office of the Air Surgeons.

## NEWS ITEMS

Edited by DR. DONALD J. LYLE  
904 Carew Tower, Cincinnati 2

News items should reach the editor by the twelfth of the month

#### DEATHS

Dr. Philip A. Delavan, Saint Paul, Minnesota, died September 12, 1943, aged 44 years.

Dr. Homer F. Wonders, Philadelphia, Pennsylvania, died August 27, 1943, aged 66 years.

Dr. Charles A. Wynn, Greensburg, Pennsylvania, died August 20, 1943, aged 74 years.

Dr. William B. Anderson, Brownwood, Texas, died July 6, 1943, aged 80 years.

Dr. William K. Foote, Omaha, Nebraska, died July 22, 1943, aged 72 years.

Dr. John J. Finerty, Derby, New York, died September 18, 1943, aged 77 years.

Dr. Charles H. McArthur, Rome, Georgia, died August 2, 1943, aged 47 years.

Dr. Walter S. Moyer, Sayre, Pennsylvania, died July 18, 1943, aged 70 years.

Dr. George H. Bell, New York, New York, died October 5, 1943, aged 77 years.

Dr. Francis G. Speidel, Washington, D.C., died August 30, 1943, aged 51 years.

Dr. Alexander W. Stirling, Baldwin, Georgia, died August 16, 1943, aged 85 years.

Dr. Walter W. Watson, Philadelphia, Pennsylvania, died August 13, 1943, aged 69 years.

Dr. Wilston Johnston, Portland, Oregon, died August 15, 1943, aged 52 years.

Dr. Omar L. Cox, Iola, Kansas, died August 22, 1943, aged 76 years.

Dr. Melvin K. Henry, Philadelphia, Pennsylvania, died August 5, 1943, aged 72 years.

Dr. Frederick H. Martin, Libertyville, Illinois, died August 18, 1943, aged 71 years.

Dr. Edwin S. Moss, Williamsburg, Kentucky, died August 23, 1943, aged 83 years.

Dr. George H. Walker, Winona, Minnesota, died July 2, 1943, aged 63 years.

Dr. John J. Brennan, Worcester, Massachusetts, died August 26, 1943, aged 79 years.

Dr. A. W. Martin, Bogalusa, Louisiana, died October 6, 1943, aged 61 years.

Dr. Frederick W. Mitchell, Houlton, Maine, died September 5, 1943, aged 69 years.

Dr. Simeon A. Daudelin, Worcester, Massachusetts, died August 28, 1943, aged 73 years.

Dr. Carl Barck, Saint Louis, Missouri, died October 2, 1943, aged 86 years.

Dr. Benjamin J. Butler, East Providence, Rhode Island, died September 18, 1943, aged 69 years.

Dr. George R. Gowen, Walla Walla, Washington, died September 2, 1943, aged 61 years.

Dr. Ellwood Harlow, New York, New York, died September 22, 1943, aged 70 years.

Dr. Frank J. Walz, Wilkinsburg, Pennsylvania, died August 2, 1943, aged 72 years.

Dr. Thomas A. Poole, Washington, D.C., died October 5, 1943, aged 72 years.

Dr. Ernst G. Sass, Lidgerwood, North Dakota, died September 15, 1943, aged 73 years.

Dr. Otis F. Simonds, Cleveland, Ohio, died September 26, 1943, aged 61 years.

Dr. David F. Waide, New Orleans, Louisiana, died September 14, 1943, aged 60 years.

Dr. Edwin W. Grubb, Akron, Ohio, died September 23, 1943, aged 73 years.

Dr. Albert J. Guerinet, Pittsburgh, Pennsylvania, died September 18, 1943, aged 66 years.

Dr. Edwin S. Leach, Junction City, Kansas, died September 15, 1943, aged 76 years.

Dr. John M. McGrath, Saint Louis, Missouri, died September 21, 1943, aged 48 years.

Dr. Joseph E. Miller, Los Angeles, California, died September 13, 1943, aged 54 years.

Dr. Samuel J. Ottinger, Philadelphia, Pennsylvania, died September 15, 1943, aged 80 years.

Dr. James L. Rogers, Spokane, Washington, died September 3, 1943, aged 65 years.

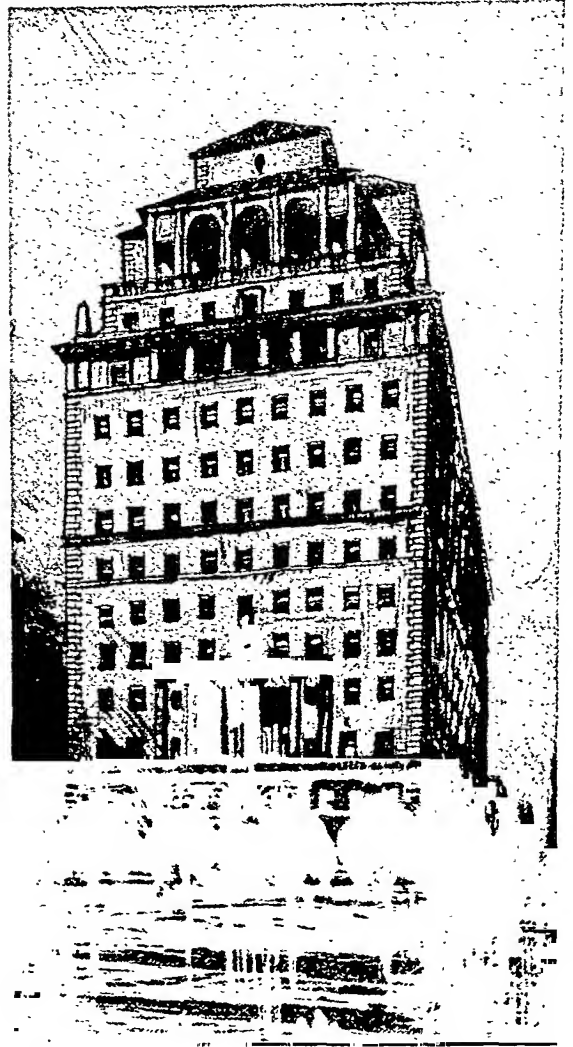
#### MISCELLANEOUS

The Rochester Orthoptic Center (approved by the Monroe County Medical Society) offers a course for orthoptic technicians. Young women desirous of making orthoptics a career and of preparing for the examinations of the American Orthoptic Council may get full particulars from Mrs. Margaret Lundean, Orthoptic Technician, 31 North Goodman Street, Rochester, New York.

The McMillan Hospital was opened for eye, ear, nose, and throat patients on October 15th. This is the only specialty hospital for diseases of these organs in Saint Louis. The present capacity is 105 beds. Two additional floors are to be used at present for neuro-psychiatric patients. These contain 55 beds. This space may be available in the future for ophthalmic and otolaryngologic patients if it is needed.

The first floor and the basement of the building have been occupied by the ophthalmology and otolaryngology departments, respectively, for 13 years. The second floor contains four operating rooms and one large lecture room. The 3d and 4th floors are now used for neuro-psychiatry and the 5th, 6th, and 7th floors for eye, ear, nose, and throat. The six floors above these are for research laboratories of the Oscar Johnson Institute, internes' quarters, occupational therapy, squash courts, and offices of departmental chiefs.

The fifth floor is the ward floor of 49 beds. There are one 10-bed division, two 7-bed, two 6-bed, one 5-bed, and four 2-bed rooms for semi-private patients. The sixth floor is for



The McMillan Hospital and the Oscar Johnson Institute.

semi-private patients and the seventh for full private patients.

The Gill Memorial Eye, Ear, and Throat Hospital will hold its eighteenth annual spring graduate course in ophthalmology and otolaryngology beginning April 3, 1944. The following will participate in the program: Drs. Paul Holinger, A. C. Hilding, M. H. Lurie, Beverly Douglas, A. D. Ruedemann, Harold Falls, Raymond Ingalls, Milton Berliner, David G. Cogan, Paul Chandler, Eugene Blake, J. S. Shipman, Major Jerome Hauser, Admiral Ross T. McIntire, and Surgeon-General Thomas Par- ran.

The next examination held by the American

Board of Ophthalmology will be April 1, 1944, in Chicago.

The Department of Ophthalmology, George Washington University School of Medicine, held its semiannual meeting on December 4th presenting the following program: "Anomalies of the discs" by Drs. William T. Davis and Ernest A. W. Sheppard; "Pemphigus conjunctivae" by Dr. Edgar L. Goodman; "Bilateral amblyopia following crushed chest" by Dr. Ronald A. Cox; "Retinal detachment in childhood" by Dr. Frank D. Costenbader; "Foreign body in cataractous lens located by Vogt X-ray technique" by Dr. Richard W. Wilkinson; "Melanoma of the choroid" by Dr. Sterling Bockoven; and "Hypertensive retinopathy" by Dr. Carmon R. Naples. Colonel Frederic H. Thorne (MC), U.S.A., spoke on "Military aspects of ophthalmology," and Dr. Davis, professor of ophthalmology at the medical school, gave an illustrated lecture on "Differential diagnosis of the vertical motor anomalies."

#### SOCIETIES

At the eighth annual meeting of the Industrial Hygiene Foundation held at the Mellon Institute, November 10th and 11th, Dr. Charles F. Kutscher, Pittsburgh, spoke on "How the inhalation of some chemicals affects the eye."

The first of a series of postgraduate conferences, held by the eye section of the Philadelphia County Medical Society on November 4th, consisted of a discussion of "The diagnosis of corneal diseases" by Dr. Alfred Cowan and a paper on "Practical points in the refraction of the eye" by Dr. Sidney L. Olsho. The following ophthalmologists will participate in the series: Wilfred E. Fry, Isaac S. Tassman, George F. J. Kelly, Edmund B. Spaeth, Walter I. Lillie, James S. Shipman, Francis H. Adler, and Louis Lehrfeld.

The twenty-sixth meeting the Reading Eye, Ear, Nose, and Throat Society was held Wednesday, November 17, 1943. Dr. Warren S. Reese of Philadelphia read a paper on "Remarks concerning ophthalmic surgery." It was announced that Dr. Pearl E. Hackman had been commissioned Surgeon Reserve in the U. S. Public Health Service. Her rank is equivalent to that of a Lieutenant Commander in the Navy.

The regular meeting of the Washington, D.C., Ophthalmological Society was held on November 15, 1943. The guest speaker was Dr. James S. Shipman of Wills Eye Hospital, Philadelphia, who discussed "Treatment of retinal detachment." Case reports on "An unusual case of corneal dystrophy" and "Subconjunctival dislocation of the lens" were presented by Dr. Joseph Dessoff and Dr. J. B. Peebles, respectively.

The new officers of the Society are Dr. Sterling Bockoven, president; Dr. Harold R. Downey, vice-president; and Dr. John R. Lloyd, secretary-treasurer.

The Ophthalmological Society of Egypt, to encourage scientific ophthalmic work, has offered the grant of a prize, the ophthalmic gold medal, for the most valuable contribution brought up before the Annual Congress of the Society, according to a recent bulletin from the headquarters in Cairo.

#### PERSONALS

Dr. Daniel B. Kirby, professor of ophthalmology, New York University, was guest speaker at the October meeting of the Cleveland Ophthalmological Club. His subject was "Cataract surgery" and the lecture was illustrated with beautiful lantern slides and movies.

Dr. Michel Loutfallah announces the opening of offices for the practice of ophthalmology at 1826 State Street, Santa Barbara, California.

Drs. H. Rommel Hildreth and Carl C. Beisbarth were recently promoted to assistant professors of ophthalmology at the Washington University School of Medicine, Saint Louis.

Dr. Peter C. Kronfeld was appointed associate professor of ophthalmology at the University of Illinois College of Medicine, and also director of education (eye) in the Illinois Eye and Ear Infirmary.

Western Reserve University School of Medicine, Cleveland, celebrated its one hundredth anniversary the week of October 24th. Among the guest speakers was Dr. Daniel B. Kirby who presented a paper on "One hundred years of progress in cataract surgery."

## TARSOCONJUNCTIVAL SLIDING-GRAFT TECHNIQUES FOR EYELID RECONSTRUCTION\*

H. SAUL SUGAR, MAJ. (MC), A.U.S.  
*Vancouver, Washington*

Since the introduction of Hughes's<sup>1</sup> method for reconstruction of the lower lid, it has been the most frequently employed method for defects involving the entire lower lid. In partial defects involving both skin and conjunctival surfaces, and under certain circumstances in complete defects, some of the other lid-splitting methods may, however, be more advantageous. These methods have therefore been assembled and briefly described. Included among them are the special techniques used in two types of cases by the author (figs. 8 and 11). These techniques may be of particular value in war injuries in which lid lesions frequently involve both skin and conjunctival surfaces.

The first lid-splitting technique for eyelid reconstruction was introduced by Landolt<sup>2</sup> in 1881. This method was used to obtain skin to cover defects in the lower lid in cases in which part of the conjunctiva remained. The upper lid was split into a tarsoconjunctival layer and a skin-orbicularis layer and the free borders freshened (fig. 1). The conjunctival layer remaining in the lower lid was inserted between the two layers of the upper lid, and the skin of the upper lid was sutured to the skin edge of the defect. Later the tissues were split to form two lids. Four years later Landolt<sup>3</sup> described

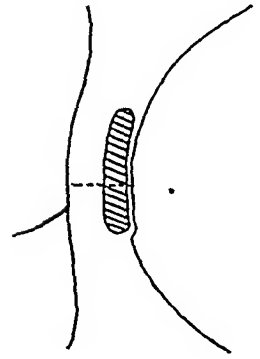
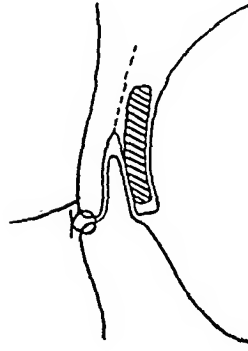
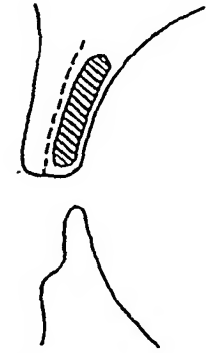
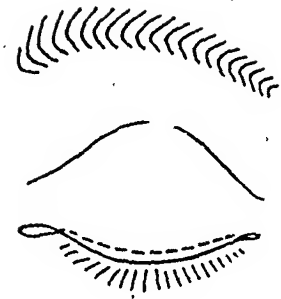
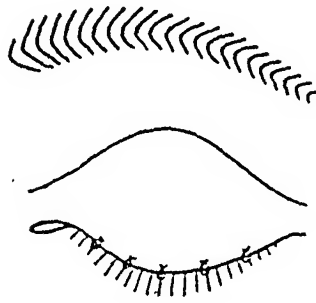
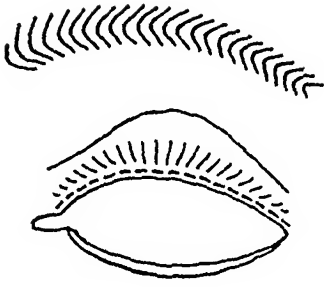
a method (fig. 2) whereby lids were reconstructed in a case in which only half of the upper lid remained. The upper-lid remnant was split and the marginal cutaneous surface freed of epithelium. The edge of the lower lid remnant was split and the skin layer of the upper lid inserted between the two layers of the lower lid and sutured. Later the tissues were split to form two lids. No cilia were transplanted.

A second useful lid-splitting technique for partial lower-lid reconstruction was introduced by Köllner<sup>4</sup> in 1911. By this method (fig. 3), the upper lid is everted and an incision made through the conjunctiva and tarsus 2 mm. from, and parallel to, the lid margin, and sufficiently long to correspond to the defect in the lower lid. At both ends of the incision a vertical incision is made through the conjunctiva and tarsus, extending upward toward the fornix. This tarsoconjunctival flap is undermined, pulled down, and sutured in place in the lower-lid defect. The skin defect in the lower lid is filled with either a free or pedicle graft. Temporary lid-margin sutures are placed on either side of the defect area.

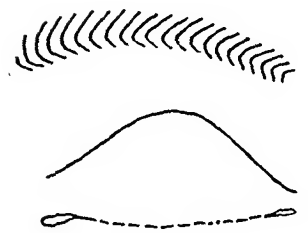
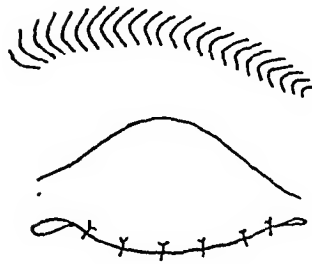
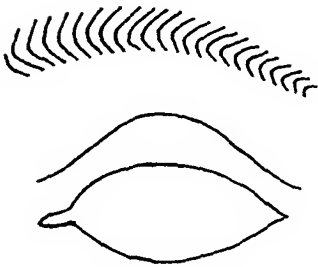
Kuhnt's automarginoplastic operation<sup>5</sup> is another procedure which may be extremely useful, particularly in cases of tumor of the lid-margin. The skin around the mass is incised in the form of an arch (fig. 4). On the conjunctival surface two incisions are made through con-

\* From the Eye Clinic, Barnes General Hospital (U. S. Army).





1

**A****B****C**

2

**A****B****C**

Figs. 1 and 2 (Sugar). Landolt's method for repairing lid defects. Fig. 1. Repair of lower lid. A, outline of incisions; B, result of repair; C, lid-splitting stage.

Fig. 2. A, outline of incisions; B, result of repair; C, lid-splitting stage.

# EYELID RECONSTRUCTION

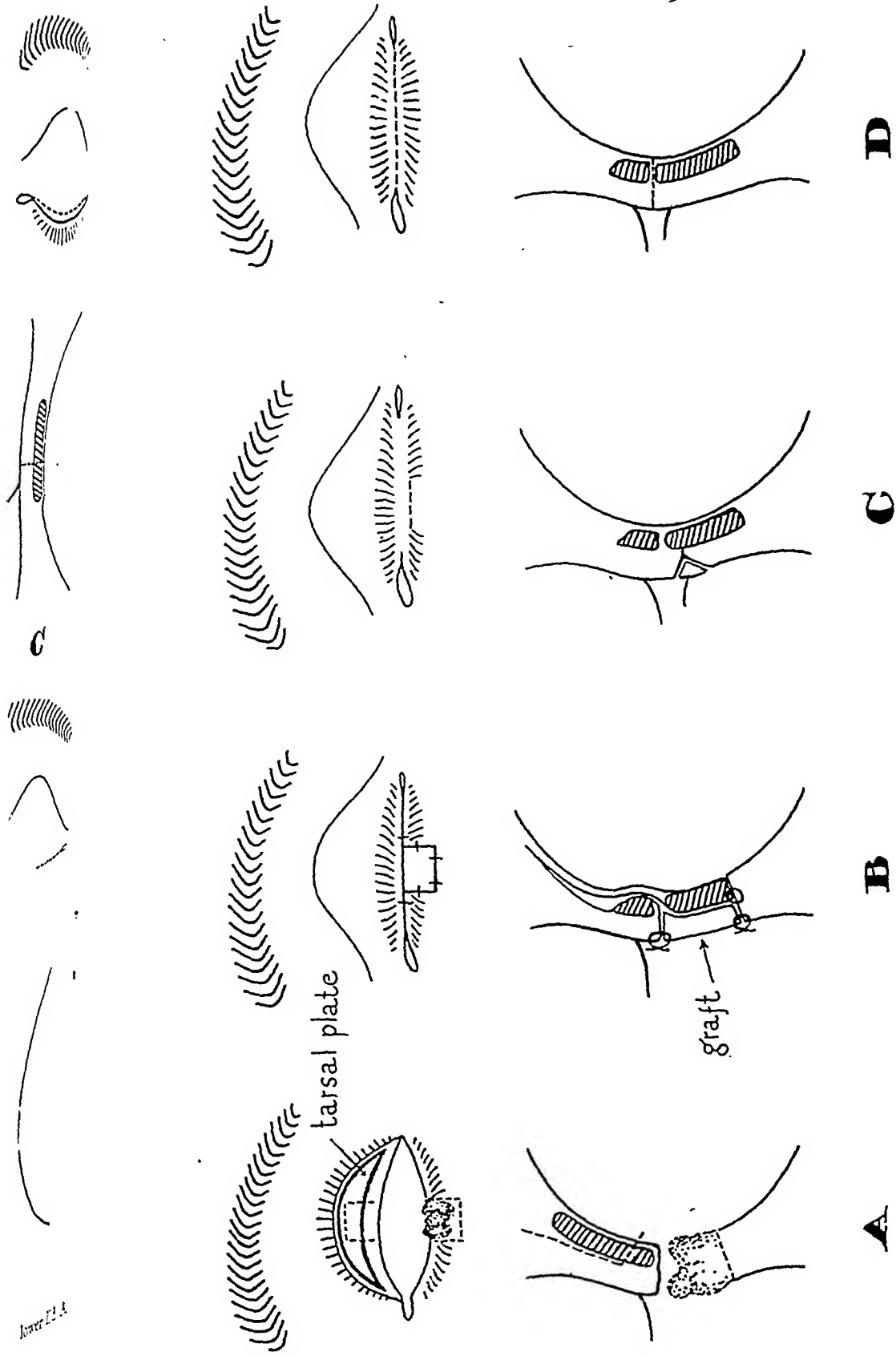


Fig. 3 (Sugar). Köllner's method. A, outline of incisions; B, result of repair; C, hair-bearing graft implant; D, lid-separation stage.

junctiva and tarsus perpendicular to the lid margin, beginning at the margin of the lid and extending in the conjunctiva to 1 cm. beyond the tarsus. Another incision is made parallel to the lid margin beyond the growth. The conjunctivo-tarsal flap thus prepared is brought toward the lid margin to fill the gap. The skin border is brought up and sutured temporarily

rim. This strip of tarsoconjunctiva is split into two flaps at a point which will permit the one on the side of the defect to approximate the conjunctival defect in the upper lid. This is rotated into position in the upper-lid defect and sutured to the upper-lid tarsoconjunctival flap. The remaining tarsoconjunctival flap of the lower lid is stretched to fill the tarso-

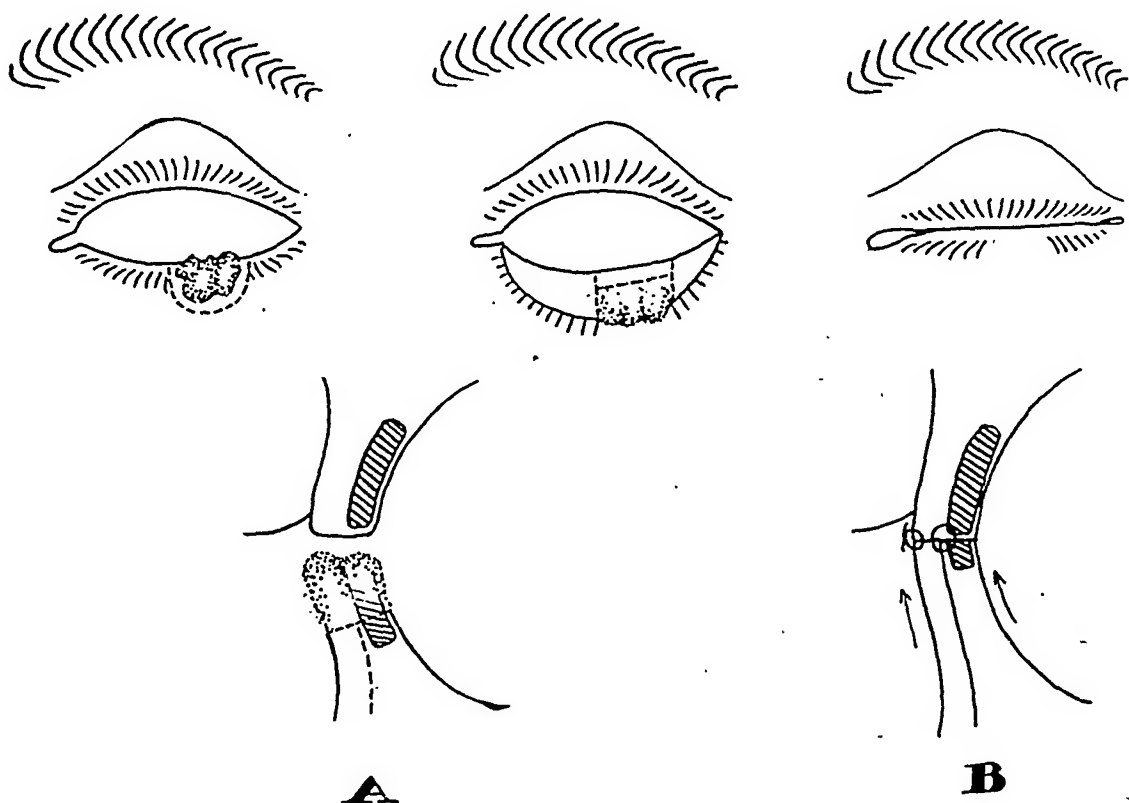


Fig. 4 (Sugar). Kuhnt's automarginoplastic operation. A, skin and tarsoconjunctival incisions; B, result of the repair.

to the upper-lid margin to fill the skin portion of the defect.

For partial defects of the upper lid Smith<sup>6</sup> described the following procedure (fig. 5): An incision is made, splitting the remaining portion of the upper lid and the intact lower lid. An incision parallel to the margin is made in the two layers of the upper-lid remnant at the level of the upper orbital rim. A similar incision is made in the tarsoconjunctival layer of the lower lid at the level of the lower orbital

conjunctival defect in the lower lid, resulting from the rotation of the other tarsoconjunctival flap, and sutured into place. This leaves only the skin defect in the upper lid to be corrected. The skin flap formed from the upper-lid remnant is drawn over as far as possible and fixed to a flap made in the skin on the other side of the defect.

A fourth lid-splitting operation is that of Dupuy-Dutemps,<sup>7</sup> described in 1927. It may be used for either partial or total

loss of the lower lid and in partial loss of the upper lid. In the first stage of this operation, if done for correction of a lower-lid defect, an incision, slightly longer than the defect to be filled, is made in the intermarginal line of the upper lid (fig. 6). The skin-orbicularis layer is separated from the tarsoconjunctival layer. The latter is sutured to the conjunctival edge of the lower-lid stump.

palpebral opening is reestablished by a through-and-through incision along the ciliary border.

The Hughes<sup>1</sup> operation for lower-lid reconstruction was described in 1937. By this method (fig. 7), the upper lid is split along the intermarginal line to about 3 mm. above the upper tarsal border. The skin of the cheek is undermined. The epithelium at the free border of the tarso-

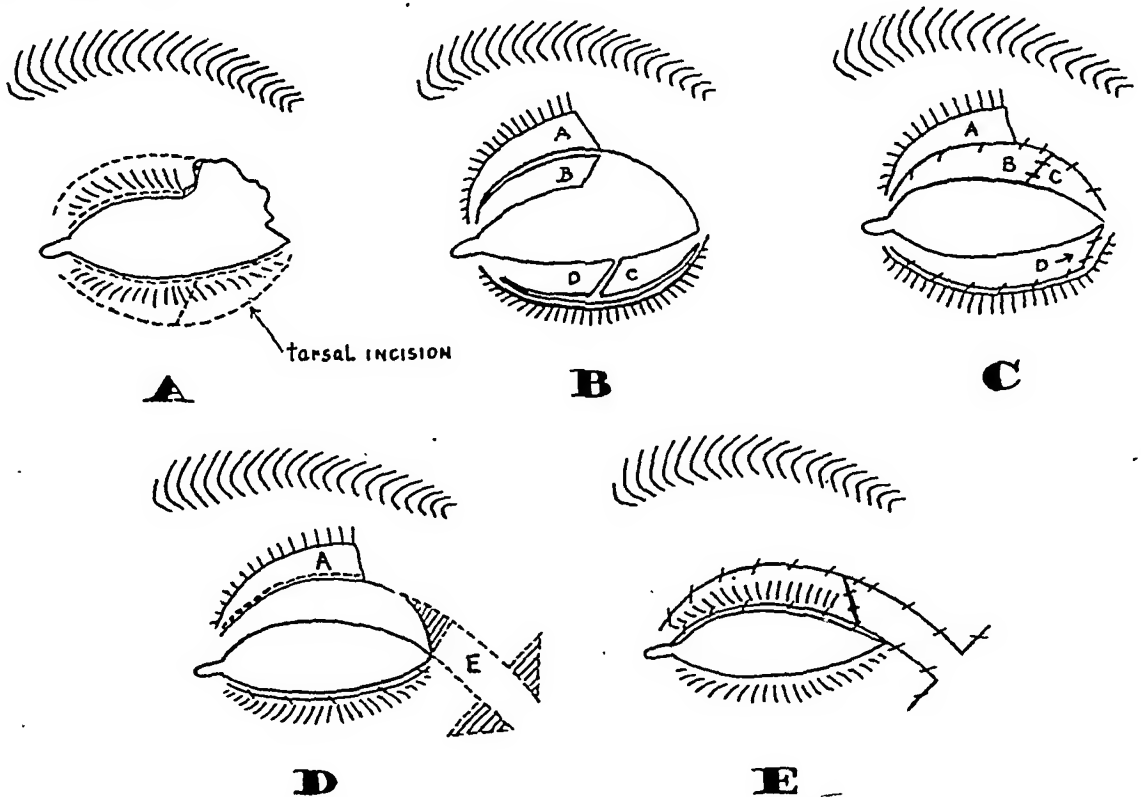


Fig. 5 (Sugar). Method described by Ferris Smith. A, outline of incisions; B, skin and tarsoconjunctival flap; C, rotation and suture of the flap C to edge of flap B—flap D is pulled over and sutured to fill the defect resulting from rotation of flap C; D, sliding flap E is formed to meet sliding flap A; E, the result of the surface repair. (After Smith.)

The skin-muscle layer is drawn downward and sutured to the skin borders of the lower-lid defect. After two weeks the second stage is done: The skin is incised just beneath the ciliary border and dissected upward so that the skin-muscle layer resumes its normal position, leaving the tarsoconjunctival layer in its new position. The skin defect is covered with a graft. Later, in two to four weeks, the

conjunctival layer of the upper lid is removed and the edge sutured to the conjunctival margin remaining in the lower fornix. The knots are left on the conjunctival surface. The skin of the cheek is drawn upward and attached to the anterior surface of the lower half of the tarsus. The skin-orbicularis layer of the upper lid is sutured to the anterior surface of the upper half of the tarsus. A

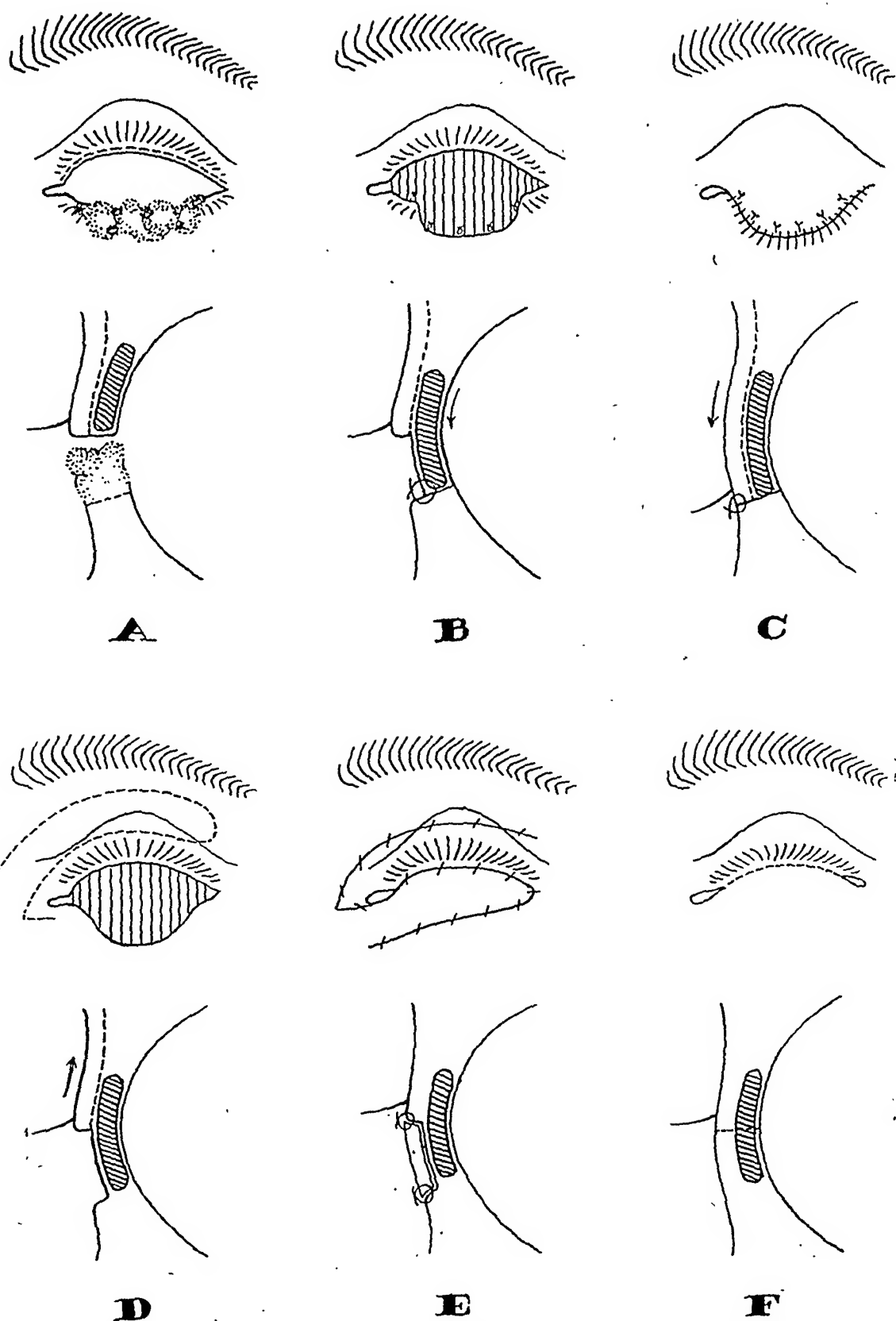


Fig. 6 (Sugar). Dupuy-Dutemps method. A, outline of incisions; B, tarsoconjunctival layer sutured to conjunctival edge of defect; C, skin layer sutured to edge of skin defect; D, skin layer returned to normal position in second-stage procedure; E, rotation of graft from upper lid to fill skin defect; F, lid-separation stage.

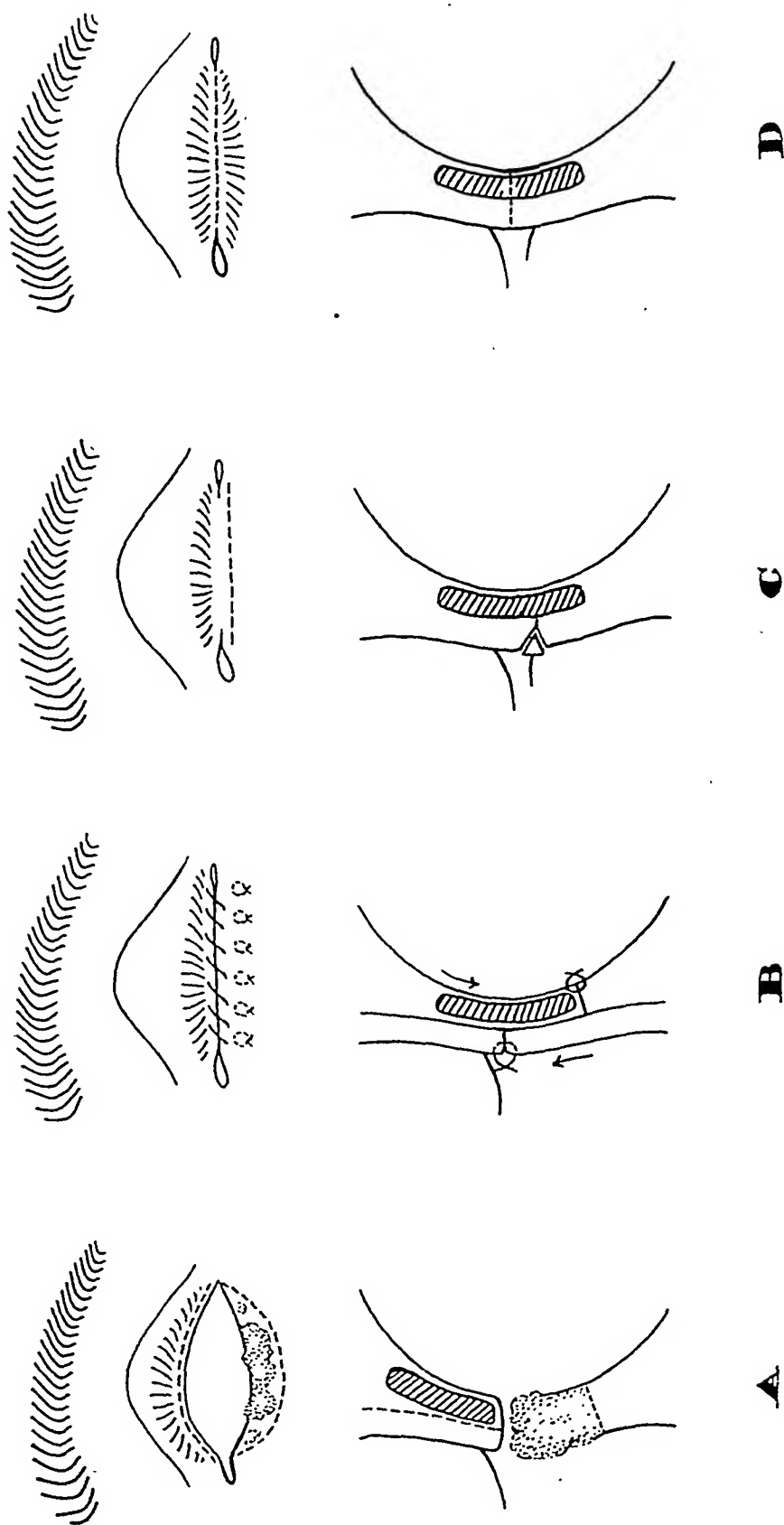


Fig. 7 (Sugar). Hughes's method. A, outline of incisions; B, result of repair; C, hair-bearing-graft implant; D, lid-separation stage.

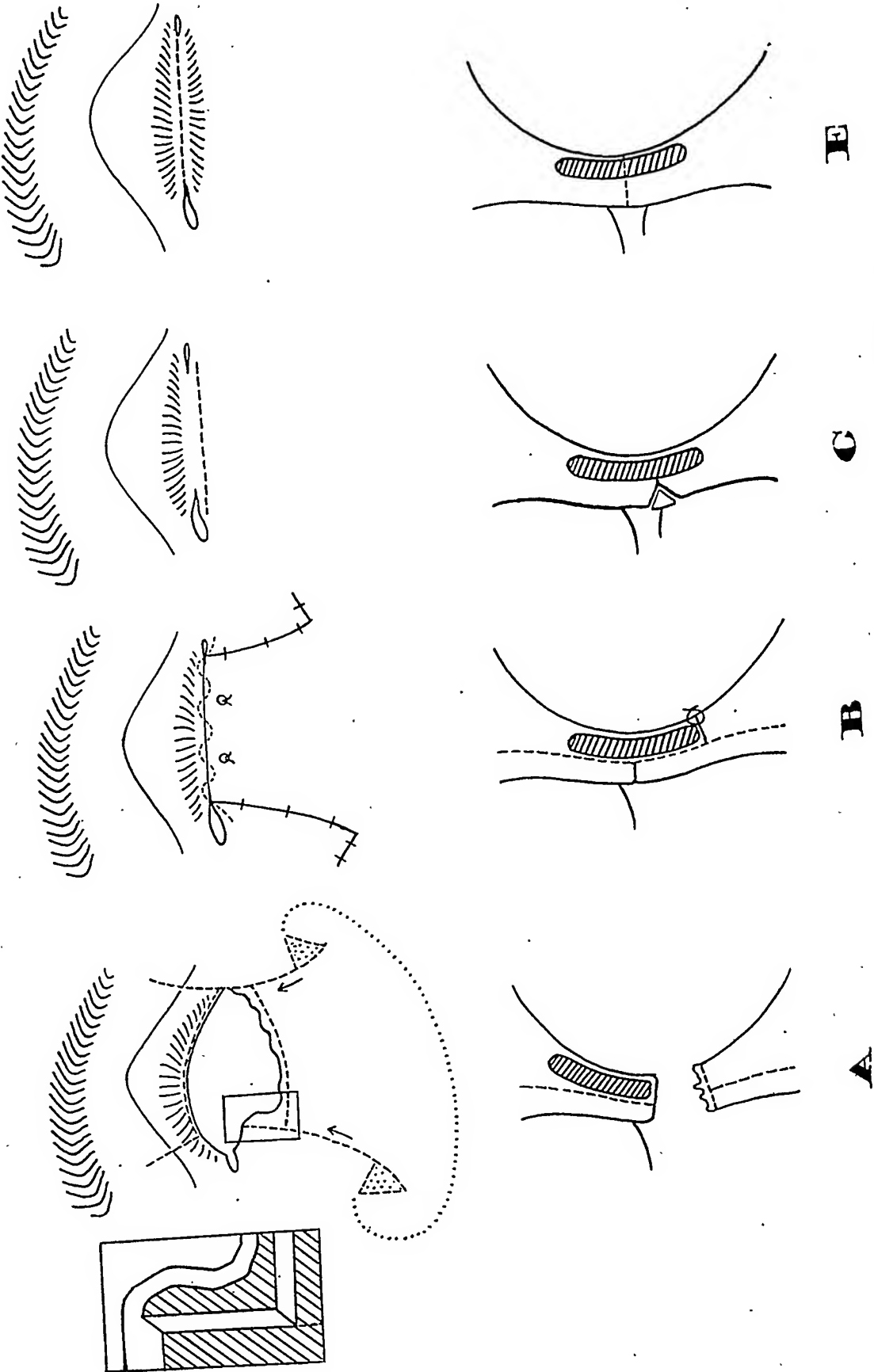


Fig. 8 (Sugar). Author's case 1. A, outline of incisions; B, result of surface repair, first stage; C, hair-bearing-graft implant; D, lid-separation stage.



subcuticular stitch is used to unite the two skin edges. At the end of six weeks a strip of hair-bearing skin is transplanted from the opposite brow to form the lower lashes, according to the method of Wheeler.<sup>8</sup> After another seven weeks an incision is made transversely between the two rows of lashes to form the interpalpebral fissure.

Gifford<sup>9</sup> has pointed out the need for leaving openings at both the inner and the outer canthi for drainage, instead of a single opening as in Hughes's procedure. He also considered the intermarginal subcuticular suture unnecessary.

Another lid-splitting operation somewhat similar to those of Dupuy-Dutemps and Hughes is that apparently used by Imre and Blaskovics and mentioned briefly by Saint Martin.<sup>10</sup> According to this method the upper lid is split and the skin of the cheek and lower-lid remnant undermined. Imre's sliding flaps are formed by curved incisions as indicated in each individual case. Burow's cutaneous triangles are removed at the ends of these incisions as necessary. Such a procedure was used by the author in cases of partial loss of the lower lid resulting from a war injury, with very satisfactory results (figs. 8, 9).

#### CASE HISTORIES

*Case 1.* Lt. V. F. P., aged 28 years, was injured by enemy gun fire June 4, 1942, when the plane in which he was the bombardier attacked a Japanese ship off Umanak, Alaska. An enemy shell exploded in the nose of the plane. A secondary missile lacerated the patient's left eye and left lower eyelid. Lacerations of the skin of the nose, left angle of the mouth, and the left forearm were also incurred. On the following day an enucleation of the remnants of the left eye was done. The fragments of the lower lid that were present were sutured into position, al-

though some of them were in such condition as to make their viability questionable. On June 12, 1942, the patient was evacuated to Barnes General Hospital. The sutured lid remnants had sloughed out and some deformity of the external

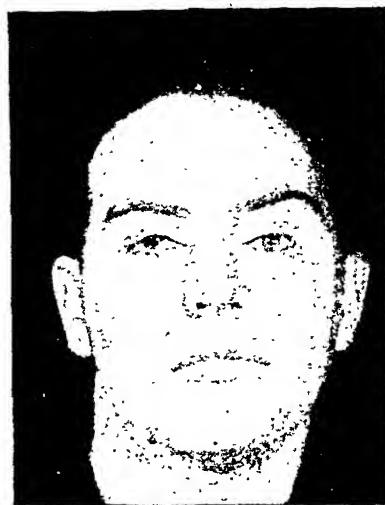


Fig. 9 (Sugar). Appearance of patient (case 1) before and after surgery. A prosthesis was inserted before photographing.

canthus was present. The lateral two thirds of the lower lid were absent to the lower fornix. Because of a desire to preserve the lacrimal punctum and the normal lid remnant the following procedure was done on June 18, 1942: The skin of the left cheek was incised and undermined as shown in figure 8. A

Burow's triangle was removed at the end of each lateral curved incision. The more nasal skin incision was made nasal to the edge of the tarsal remnant so as to give the effect of Wheeler's "halving" operation. The upper lid was then split into a tarsoconjunctival and a skin-orbicularis layer, beginning at the intermarginal line and extending to about 4 mm. above the upper tarsal border. The tarsus was incised vertically at the external canthus and at the junction of the inner and middle thirds to fill the defect in the lower lid. A prosthesis was inserted to give the lids form. The free edge of the tarsal layer was denuded of epithelium and sutured to the conjunctiva of the lower fornix, leaving the knots on the conjunctival side. The skin of the cheek was brought up and sutured with three vertical silk sutures to the lower half of the tarsus. A subcuticular suture was placed between the two cutaneous edges. A thin rubber drain was inserted at the inner canthus and at the lacerated outer canthus. The cilia were held up with collodion. A pressure dressing was applied. On the sixth postoperative day the dressing and sutures were removed. A small epithelial defect in the upper outer corner of the graft was present. Two attempts to place a small free partial-thickness skin graft over the area were unsuccessful because of the constant secretion from the opening at the outer canthus. The defect healed well of its own accord, however. On August 2, 1942, a horizontal incision was made just below the intermarginal adhesion, extending down to the tarsus. A wedge-shaped hair-bearing graft  $1\frac{1}{2}$  mm. wide at the skin surface was removed from the right brow. This was turned end for end and inserted into the trough in the left lower lid and sutured into place. The brow incision was closed with interrupted sutures. A pressure bandage was applied

to the left lids. On September 15th, a through-and-through incision was made at the lower border of the left upper lid. The prosthesis was removed. The conjunctival sutures and granulation tissue were removed, the prosthesis reinserted, and a dressing applied. Healing was uneventful.

*Case 2.* Lt. R. K. U., aged 23 years, received multiple shrapnel wounds from 20-mm. cannon fire on September 11, 1943, while serving as co-pilot on a bombing mission over Paramushiro. One fragment, 2 by 0.5 by 1 cm. in size, passed through the right eyeball and entered the right posterior inferior ethmoid sinus. The lateral third of the right lower lid was excised by a piece of plexiglass from the windshield. The eye was eviscerated on September 13, 1943. On October 26, 1943, the patient was admitted to Barnes General Hospital. The conjunctiva was continuous with the skin where the lateral third of the right lower lid was missing. The conjunctiva was clean but considerably shortened. On November 1, 1943, the lateral third of the upper lid was split, and the tarsoconjunctival layer sutured to the freshened conjunctival margin of the lower-lid defect exactly as was done in case 1. The skin of the cheek was incised and sutured to the lower half of the tarsus as in case 1. No prosthesis could be inserted as a mold. On the sixth postoperative day the dressing and sutures were removed. On November 22, 1943, a hair-bearing graft, 12 mm. in length, from the left brow was inserted into an incision in the new lower lid, as in case 1. Three weeks later the lids were split. Because of the lack of sufficient conjunctiva to permit insertion of a prosthesis, the temporal half of the conjunctiva was split on December 23, 1943, and undermined to permit insertion of a mold and a mucous-membrane graft from the lower lip. A mold of the same size and

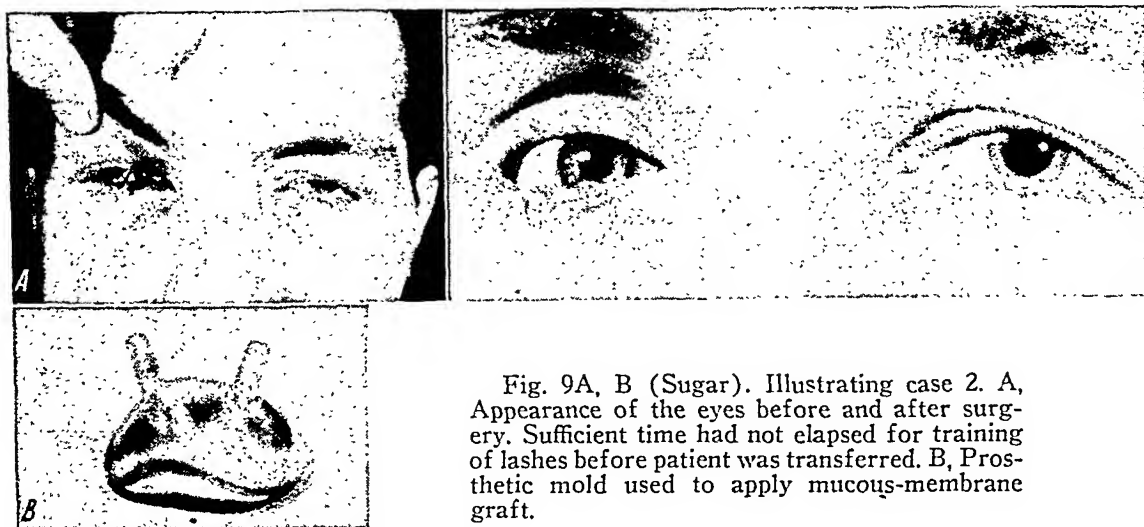


Fig. 9A, B (Sugar). Illustrating case 2. A, Appearance of the eyes before and after surgery. Sufficient time had not elapsed for training of lashes before patient was transferred. B, Prosthetic mold used to apply mucous-membrane graft.

shape as an artificial eye was made of transparent acrylic by Capt. E. V. Lambrechts of the Dental Department, according to the description by Penn and Brown,<sup>11</sup> except that, instead of perforating the mold with steel tubes to drain secretions accumulated behind the mold, perforated extensions continuous with the rest of the acrylic mold were used (fig. 9A, B). The mold was removed in five days, leaving a clean, well-grafted socket. A temporary artificial eye was introduced three days later preparatory to transferal of the patient to a center where a proper prosthesis could be made.

The procedure used in these cases embodies several important principles of lid reconstruction including: 1, lid-splitting; 2, the use of the Imre sliding flap with Burow's triangles; 3, the Wheeler hair-bearing-graft transplant to form lashes; and, 4, the Wheeler<sup>12</sup> principle of "halving" whereby the skin and tarsoconjunctival layers are united at different levels to minimize scar contraction.

As a result of the experience with these cases I am convinced that tying the sutures which unite the conjunctival layers on the conjunctival side introduces a source of irritation. It is possible in a case in which the globe is intact that a serious corneal ulceration may result. It

might be wiser to place the sutures from the skin side and tie them after passing them through the undermined skin of the cheek at the proper level. Not only would they then permit earlier removal of the suture material but would serve instead of the vertical tarsus-skin sutures to hold the graft up to relieve tension.

A lid-splitting method for reconstruction of the upper lid for carcinoma was described by McLean<sup>13</sup> in 1941. By this method (fig. 10) two incisions are made through and through the normal tissue on each side of the growth perpendicular to the lid margin, and another parallel to the lid margin, delimiting the involved tissue. At each corner a Burow's cutaneous triangle is removed. The levator muscle is isolated and secured. The lower lid is split and the tarsoconjunctival layer attached to the conjunctival edge of the upper-lid defect after its edge has been freshened. An orbicularis strip from the upper lid is swung down over the transplanted tarsus. The skin above the defect is drawn down and sutured to the edge of the skin layer of the lower lid. Later a hair-bearing graft is inserted, according to Wheeler's method. As a final stage the lids are split.

For contiguous lesions of both lids

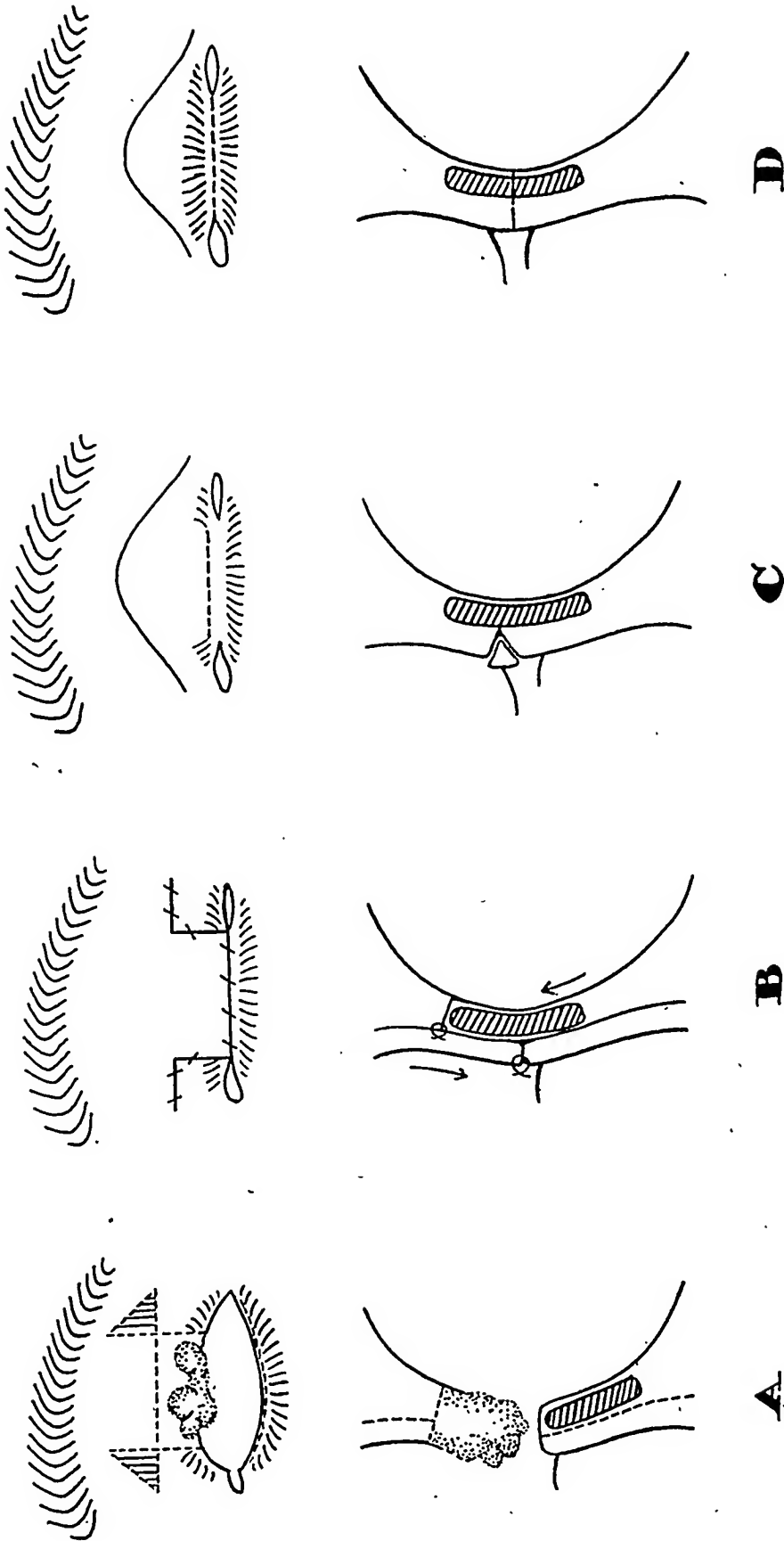


Fig. 10 (Sugar). McLearn's method. A, outline of incisions; B, result of repair; C, hair-bearing-graft implant; D, lid-separation stage.

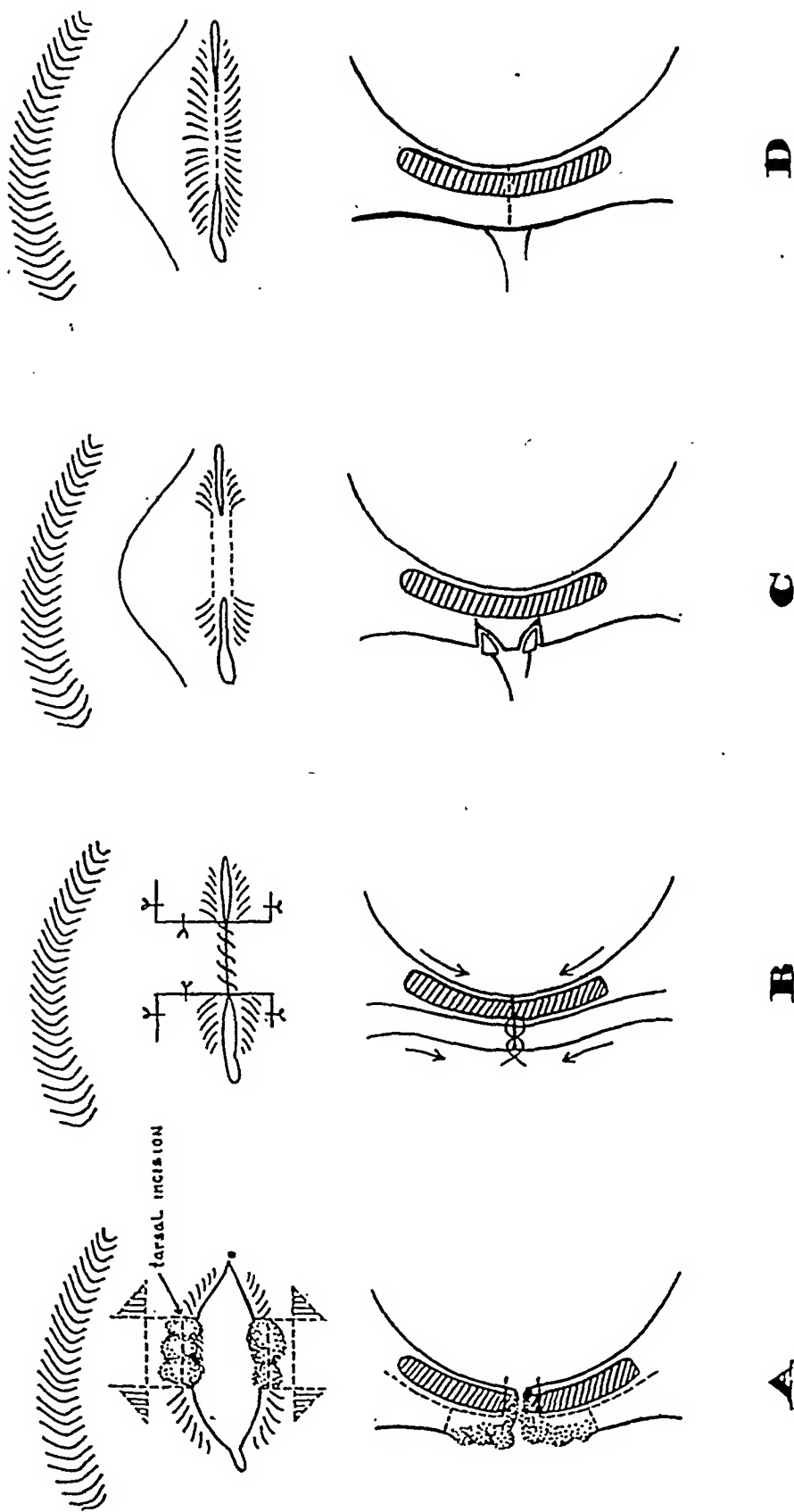


Fig. 11 (Sugar). Author's case 2. A, outline of incisions; B, result of repair; C, hair-bearing-graft implants; D, lid-separation stage.

I have used a method (fig. 11) described in the following case history:

*Case 3.* Pvt. R. O. B., aged 27 years, was admitted to Barnes General Hospital on April 8, 1943, because of inability completely to close his right eye owing to the presence of contiguous growths on the margins of both right lids. The upper mass had been present since birth, the lower was first noted at the age of 12 years; both had grown moderately in size. The upper mass measured 14 by 6 mm., whereas the lower measured 6 by 12 mm. in size. Both extended about  $1\frac{1}{2}$  mm. on the conjunctival surface. The pathologist's diagnosis was papillary pigmented intradermal nevi.

On April 13, 1943, the skin was incised as shown in figure 11, in the same manner as followed in making McLean's skin incisions except that only a small border of normal skin was included. Burow's triangles were removed from the four corners. The skin was undermined beyond the excised areas. The tumor masses were removed, leaving the tarsoconjunctival layer intact except for  $1\frac{1}{2}$  mm. at its free border on each lid. The tarsi were incised at the lateral margins of the defects without going through the conjunctiva so that the tarsal margins could be sutured together without leaving a gap between them. The sutures were brought out through the flap edges and tied. The skin edges were then united with interrupted sutures. The sutures were removed on the fifth postoperative day. On April 27, 1943, horizontal incisions were made just above and below the intermarginal adhesion, extending along the tarsus above and below. Thin hair-bearing grafts were removed from the left brow and sutured into place in the troughs. The brow incision was closed with interrupted sutures. The sutures were removed on May 1st, at which time collodion was used to direct the hairs into the proper posi-

tion. On May 12, 1943, the lids were separated. Healing was uneventful.

This procedure was planned as a combination of the methods of Köllner and McLean. However, only a small amount of tarsus was found to be involved. In cases presenting more involvement of the tarsus, a through-and-through vertical incision of the tarsus and tarsal conjunctiva should be made on each side of the

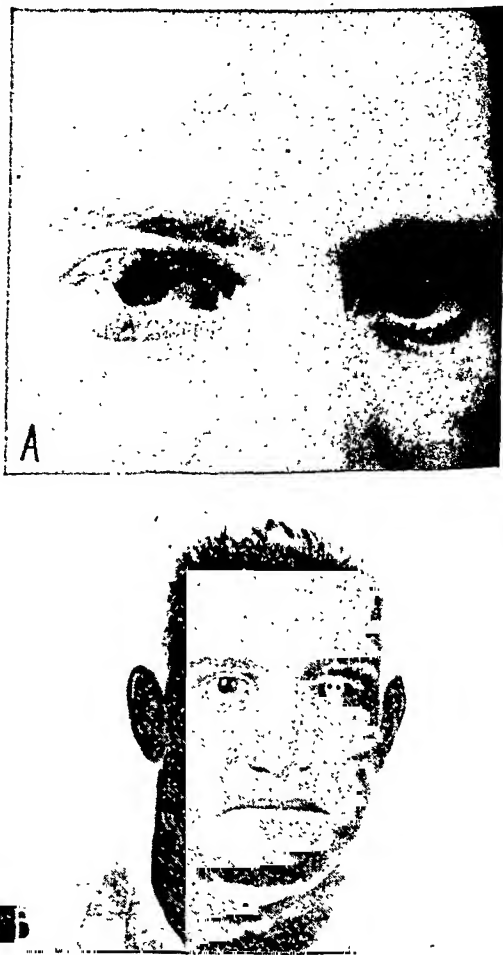


Fig. 12 (Sugar). Appearance of patient (case 3) before and after surgery.

lesion in each lid, either continuous with the cutaneous incisions or slightly away from them so as to produce the effect of "halving." The incisions should extend for 4 mm. or more in the conjunctiva and a tarsoconjunctival or conjunctival flap formed by undermining. The conjunctival or tarsoconjunctival flaps from

the two lids should then be united by sutures that are continued through the cutaneous flap margins and through small pieces of rubber over which they are tied.

It will be noted that in both procedures used by the author the same four principles were considered and may be applied in any case where tarsoconjunctival sliding grafts are used. These are, in recapitulation: (1) splitting the lid into tar-

soconjunctival and skin-muscle layers; (2) use of Imre sliding skin flaps with Burow's triangles, where indicated; (3) use of the Wheeler method for forming lashes; and (4) use of the Wheeler "halving" principle, where applicable. These principles may be applied in the repair of lid colobomas, traumatic defects, and the defects resulting from the removal of tumors.

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# THE DEVELOPMENT OF A SYSTEM OF INTRACAPSULAR CATARACT EXTRACTION

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In the descriptions of new procedures in intracapsular cataract surgery various authors have conveyed to the reader their particular techniques, but they have not given the variations and indications necessary to adapt the manipulations to the case in hand. They have not told what to do next, if a particular procedure fails to produce the desired result.

The present writer has made it a habit to examine patients and their eyes carefully, with all necessary devices, before operating and then to continue his observations before and after each maneuver during the operation. He has looked and has seen what he has accomplished before he has proceeded to the next maneuver. Manipulations have been varied according to indications as they presented.<sup>1</sup> Gradually there has been developed a system of intracapsular cataract extraction, which may be defined as an orderly array of thoughts on this particular subject. When once the decision has been made to remove the cataract in capsule, the surgeon has a better chance of success if he has formulated in his own mind the procedures which he will apply under certain conditions and if he is prepared to vary them if the conditions change.

One cannot anticipate by age, physical condition, nor local examination of the eye, even with the microscope, just how the operation will proceed. If all of the possible contingencies, emergencies, or complications<sup>2</sup> have been encountered in practice or in teaching, and are anticipated, then the unexpected becomes the expected and is no surprise. One may then assay the situation more calmly and

proceed with a cold and scientific accuracy of thought and precision of application which leads the way out of disturbing situations and even out of complications that might be distressing.

The observations and procedures described in this paper have been developed in the course of private surgery, not with any idea of experimentation but because a previously or spontaneously developed idea seemed to fit a particular situation, was applied, and was then reapplied when a similar situation arose. Ward or clinic patients in the author's service were all operated upon by residents in their training in extracapsular or intracapsular surgery, as indicated in the particular case. No cases have been used for demonstration purposes.

## THE BASIS OF THE SYSTEM

The exposition of the system of intracapsular cataract surgery in this paper will be chiefly concerned with the behavior of the lens capsule, cortex, nucleus, zonule, and vitreous. It is necessary to consider not only the cases with intact zonules in which there is apparently normal anatomic position of the lens and vitreous but also those in which there may be subluxation or luxation of the lens, either through congenital malformation, degeneration, or through trauma.

## INTRACAPSULAR DELIVERY OF LUXATED AND SUBLUXATED LENSES

In all cases of subluxation or luxation the placement of efficient corneoscleral sutures prior to incision is indicated. In

congenital cases and in certain cases in which minor trauma caused luxation or subluxation of a cataract with a fragile zonule, the hyaloid may be intact and it may be possible to remove the lens without loss of vitreous; but in severe traumatic cases, the vitreous and the hyaloid are greatly disturbed and loss of vitreous is to be expected and prepared for. If the lens is completely free from its zonular attachments, the ligamentum hyaloidea capsulare may support the lens in position. In clinical surgery, in cases of cataract, there is little evidence that the ligamentum hyaloidea capsulare is any more than anatomic coaptation, except in rather rare pathologic instances where the hyaloid seems to be adherent to the posterior lens capsule. It is possible that in the normal eye there is a slight degree of cohesion and that this property is diminished when the ligament degenerates with the development of cataract.

*Luxation of the lens into the anterior chamber.* Differentiation of this condition in certain instances must be made from hematogenous staining of the cornea. Removal of the luxated lens in capsule from the anterior chamber is definitely indicated because if increased intraocular pressure has not already developed it will undoubtedly ensue. If the intraocular pressure is not elevated, a small peripheral incision, avoiding injury to the lens capsule, may be made with the knife and then enlarged with scissors. The lens may escape as soon as the incision is large enough or it may be withdrawn by traction with suitable forceps, suction cup, or with a loop.

*Increased intraocular pressure in cases of luxated lenses.* If the intraocular pressure is increased, the opening of the anterior segment is hazardous because of the crowding forward of various struc-

tures, and the danger of hemorrhage and of iris and vitreous prolapse. The writer has not made use of his plan as yet to lower the intraocular pressure, in cases of subluxated or luxated lenses, by drainage of the vitreous. He would do this, not by posterior scleral puncture with a knife but by a method which has worked well as a preliminary to an anterior operation in certain cases of glaucoma. After exposure of the sclera in the inferior temporal quadrant by conjunctival and Tenon's-capsule dissections, the sclera in an area 10 to 12 mm. posterior to the limbus is trephined to the choroid. The latter naturally bulges into the opening. Electro-coagulating current of intensity similar to that used in the operation for reattachment of the retina is used to pierce the choroid, then the retina, then the internal limiting membrane or hyaloid, whereupon the vitreous is permitted to escape slowly. The relations of the structures in the anterior segment then may appear more normal. Even though the initial limbus incision may be difficult in a decompressed eye, it seems to the author that this may prove to be a better way out of the emergency than a primary anterior drainage. This procedure is recorded here as an untried example of the preparation for an emergency in the development of the system of intracapsular cataract surgery. It is not recommended and it may be necessary to discard it, but it is nevertheless recorded for the sake of completeness.

*Luxation of the lens with retention of its position in the patellar fossa.* It is possible, although not probable, that the lens may remain in the patellar fossa even though completely free from the zonular attachments. The hyaloid must necessarily be intact for this condition. The lens may be removed by traction alone, with

the forceps, suction cup, or with the loop.

*Luxation of the lens into the vitreous.* This condition may develop as a result of malformation or degeneration of zonule and vitreous or because of trauma either accidental or during the process of cataract surgery. Except in the last-named instance, the position, movement, or fixation of the luxated lens should first be carefully studied with the ophthalmoscope and particularly with the aid of the phenomenon of fluorescence of the lens by suitable devices.

If the lens will come forward when the patient lies face down, it may settle into the anterior chamber through the dilated pupil and then be imprisoned by the action of miotics, later to be removed through an anterior incision. If one does not succeed in moving the lens in this manner, the procedure will then depend upon the question of whether the vitreous is abnormally fluid or normally viscid.

*Luxation into fluid vitreous.* If abnormally fluid, the seepage of fluid vitreous directly after the incision, with lowering of intravitreal pressure to that of the atmosphere, is expected. The procedure described by Verhoeff,<sup>3</sup> of floating a lens that is not adherent up to the anterior region of the eye, where it may be picked up by forceps or by loop and removed, should be tried. If the lens is adherent to the internal limiting membrane or to a false membrane on the retina, the prognosis for removal and restoration of function is poor.

*Luxation into viscid vitreous.* If the lens is luxated into viscid vitreous, there seems to be no option but to use the loop. The application of forceps or suction tip to lens capsule through intervening vitreous is out of the question.

*Toilet of the incision after loss of vitreous.* A complete, wide iridectomy should have been made in preparation for loss of viscid vitreous, in cases of traumatic luxation of the lens, so that when the preplaced corneoscleral sutures are tied to close the incision effectively, there will be no iris incarceration. It is difficult to replace the iris pillars when viscid vitreous is in the incision. A miotic may be used to help keep the iris from becoming incarcerated. Any vitreous that protrudes should be cut off flush with the incision. Careful and unhurried closure of the incision will help in the healing of such eyes.

*Subluxation of the lens.* This may develop through congenital malformation, degeneration, or through trauma.

*Congenital malformation with subluxation of the lens.* The zonule may be incompletely formed and may be the cause of unilateral or bilateral, usually symmetrical, subluxation of the lens. The lens is small and spherical or nearly so. The hyaloid is usually intact and the vitreous self-contained, although this may not be true. If the vitreous and hyaloid are intact, an attempt should be made to remove the lens without loss of vitreous. This may be accomplished as in the experience of the author in the case of a woman, aged 52 years, who had an upward subluxation of the lens in the right eye. Preplaced appositional sutures of the McLean<sup>6</sup> type were inserted. A preliminary iridectomy had been made by another surgeon. The author's plans in a similar case would be to perform only a peripheral iridotomy. Incision was made in the usual upper segment of the corneal limbus. The central suture was used to retract the corneal flap, giving a direct view of the lens capsule and permitting the blades of the intracapsular lens-cap-

sule forceps to be placed ever so lightly upon the capsule, to be closed, picking up a portion of the capsule, to draw the lens down so that the zonule was exposed. This permitted it to be stripped off the capsule with the aid of the rounded elbow of the author's lens-expressor hook. The lens was thus delivered without presentation or prolapse of vitreous. The sutures were tied. There was no incarceration of iris tissue, so that it was not necessary to use the iris repositor. A miotic was instilled. The final healing and result were satisfactory. The usual procedure in cases similar to that just described is to attempt to remove the lens with the loop.

*The zonule of the young is resistant and elastic.* Observations have been made in such cases in young individuals who have very elastic zonules which resisted several attempts to withdraw the lens, the latter eluding the loop when nearly out of the eye and springing back to its original position as if drawn there by a very live elastic band. It is not known whether such a zonule may be stripped off by the dull elbow of the lens-expressor hook. If not, a sharper zonulotome, such as an iris spatula, may be in readiness to divide such a zonule rather than permit the lens to escape from the loop. The repetition of the ineffective maneuver of traction alone in such a case is to be avoided.

*Subluxation of the lens through trauma or degeneration associated with cataract formation.* Careful examination should be made to determine, if possible, the portion of the zonule that is still intact and attached to the lens before the section is made. If this can be discovered, the incision may be placed so that the loop may be passed through the open area and not through the intact portion of the zonule; thus the danger of com-

pletely luxating the lens into the vitreous is avoided. In many instances the intact area is not apparent, and is discovered only after the section has been made. The expected loss of vitreous is to be anticipated with preplaced sutures and by iridectomy. Trauma that will subluxate the normal lens will surely disturb the vitreous greatly. If the intraocular pressure is increased, recourse may be had to posterior draining before the anterior incision is made, as described previously.

If the intact zonule is in the inferior position, the lens will tend to swing backward on the zonular hinge. It may be brought forward by the loop, which is passed behind it from above. If the intact zonule is on one side or the other, the loop may be rotated over the opposite equator of the lens to get behind the lens and bring it forward. If the intact zonule is above, a variation of the incision from the straight horizontal to one or the other oblique may be made. Then the loop may be passed and rotated over the equator of the lens. If the straight horizontal incision has already been made, it may be possible to use the loop in a similar manner or to clear the vitreous from the upper face of the anterior equatorial region and apply the suction cup, using no pressure. These manipulations have all been employed by the author. No one can be satisfied with the appearance of an eye after it has been subjected to a wide iridectomy and the apparent necessary and expected loss and incarceration of vitreous, in traumatic cases. The patient, however, may be considered fortunate to preserve any visual function at all after such severe injuries.

In cases of degeneration of the zonule with minor trauma, conditions may be such that vitreous loss need not be experienced in the removal of subluxated lenses.

## INTRACAPSULAR CATARACT EXTRACTION IN EYES WITH INTACT ZONULES

The indications for intracapsular cataract extraction have been discussed frequently. The writer does not consider that there is any hard and fast rule in the matter. In general, unless there is a special sensitivity to the substance of the cataract, cases of mature senile cortical and of dense nuclear sclerosis may do as well with extracapsular as with intracapsular extraction, although the number of operations required to achieve the final visual result will be greater in the extracapsular group because of the discissions required should aftercataract develop. In cases of intumescent cataract in which the capsule is taut, and resists the application of the forceps, intracapsular extraction may be performed with pressure or traction alone, with a suction cup if the zonule is fragile; but if not, it is better that the capsule be opened and the extracapsular procedure employed or the cataract be permitted to progress to maturity and the choice of procedure deferred until then. The intracapsular procedure is the method of choice in cases of luxated and subluxated cataract; in hypermature cataract, either of the shrunken or Morgagnian type; in cataract complicating glaucoma either primary or secondary to inflammation, in cases of exfoliation of the lens capsule, uveitis, and retinitis pigmentosa. When the intraocular pressure is low, the intracapsular procedure may be used if the zonule is fragile, otherwise the extracapsular operation should be employed. If the decision has been made to remove the lens in capsule this should not be regarded as final and permitting no deviation because a mishap may turn the procedure into an extracapsular one should a tear in the capsule supervene. The surgeon may also decide after an effort that the risk is too

great and change over to the extracapsular procedure. However, any surgeon who elects to start an intracapsular extraction should be prepared to carry it through confidently to a successful conclusion with a minimum of trauma and complications and certainly without inflicting any greater trauma on the eye or causing any greater complications on the average than would be incurred if the extracapsular procedure were routinely used. Results speak for themselves and while surgeons like Weeks, Wheeler, and others have had most enviable records and a long history of success with the extracapsular operation, immediate and long-continued, beautiful results are obtained with the intracapsular method. The writer was trained in the extracapsular procedure and had 10 years of experience with it. Now he has had 10 years of experience with the intracapsular procedure. Because of the relatively infrequent inflammatory reaction, the low incidence of secondary rise of intraocular pressure and other complications, and the large percentage of cases in which it can be applied with as reasonable an expectation of success as the extracapsular, he has permanently adopted the intracapsular procedure, to be used when indicated.

*The iris.* The successful intracapsular extraction together with a completely mobile, round pupil offers the ideal result. The choice of the round pupil may be made in any case in which the pupil will dilate to 6 mm. or more. It may be made if the pupil dilates only to 5 mm., should the cataract be small. In case the iris is rigid and the pupil will not open to more than a diameter of 4 mm., a complete coloboma is necessary. In difficult cases and when it is impossible to get a peripheral grasp of the lens capsule at or near the equator, the coloboma of the com-

plete iridectomy facilitates the operation. A miotic is used after the successful intracapsular operation.

*The zonule.* The writer has found by clinical surgical experience that about 15 percent of the zonules are fragile, 70 percent have average resistance, and the balance have above the average resistance and resiliency.

There is no age group into which these three classes fall. One might expect resistant zonules in the younger group of cataract patients, and the weakest zonules in those over 60 years of age, but the conditions found do not permit such a classification—they undoubtedly vary in racial units. The early deterioration observed in certain of the Asiatic groups provided more fragile zonules than those found in the Caucasian groups. The normal healthy human zonule is undoubtedly very resistant and resilient. There is probably always some degree of degeneration of the zonule in every case of cataract.

#### METHODS AND PROCEDURES

A brief review of the history and of the methods and procedures devised by various surgeons was given in a previous article.<sup>1</sup> The author has developed a method of using pressure before the application of traction and rotation of the lens. He has used it with success in cases in which the zonule ruptures easily on slight pressure, and in those cases in which an average amount of pressure, traction, and rotation is necessary to cause rupture of the zonule and provide for delivery of the cataract. The preliminary pressure that is used to subluxate the cataractous lens is applied with the point of a hook (preferably not a heavy or blunt point but a flattened point, such as is found on the Jamison muscle hook). Point pressure (approximately

2.5 mm. by 0.5 mm.) is preferred to pressure with a ring or with the side of a lens spoon; for the point reaches down to the space between the corneal ring and the equator of the lens, whereas the broader instruments do not do so. The author has devised an intracapsular lens expressor, using the Jamison hook tip on his own 5-mm.-diameter light-weight cylindrical handle. The pressure is applied just inside the clear periphery of the cornea, the ring of the limbus being easily and distinctly felt. The principle involved in the confinement of pressure to this inside circumference of the cornea lies in the applied anatomic fact that the lens diameter (approximately 10 mm.) is less than that of the transparent cornea (approximately 11.5 to 12 mm.) and, therefore, the zonule attached to the equator of the lens is just inside the corneal periphery. The flattened point of the hook, as described, may be insinuated between the lens equator and corneal periphery, reaching the zonule through the thickness of cornea and iris. The point first pressed upon is at the 6-o'clock position on the corneal dial; next, another point is pressed upon at 8 o'clock, and then at 4 o'clock, a slight stripping movement being used, designed to slide down over the convexity of the inferior equator of the lens and release the zonular fibers from their attachment at the equator. The manipulations may be repeated once and possibly twice to achieve the result. As an alternate to point pressure, circumferential pressure in curvilinear fashion inside the ring of the limbus of the cornea may be applied, gradually covering almost all the lower semicircle of the limbus. The degree of pressure and indentation of the cornea varies in the individual case. In general, however, the pressure may be described as rather sudden and sharp, indenting the cornea 2 to 3 mm. but within the limits of what may

be regarded as safe. Indications of yielding and of rupture of the zonule and the movement of the lens, its tilting, and presentation when subluxated, must be learned by experience. It may be said that when the zonule has ruptured there is less resistance, and the body of the lens rises. It is never necessary, in an attempt to remove a cataract in capsule, to apply pressure over the white portion of the sclera, thus traumatizing the ciliary body and disturbing the vitreous body. The reasons for taking the preliminary steps of rupturing the zonule below before applying the forceps are (1) that greater ease is experienced in picking up the capsule that has been relaxed by rupture of a portion of the zonule; (2) that a shorter period of time is required for the delivery of the lens after the forceps have been applied. It is believed likewise that the preliminary pressure is also sufficient to sever the light union, cohesion, or close coaptation that exists at the ligamentum hyaloidea capsulare between the lens and the vitreous without any injury to the latter.

*Contraindication to the use of pressure.* The initial pressure is not used when there are indications of increased intra-vitreous pressure as evidenced by gaping of the wound, creasing of the incision from puncture to counterpuncture, or repeated prolapse of the iris that resists reposition.

*Delivery of cataracts with fragile zonules.* The initial pressure applied before any traction is used may accomplish the subluxation of the cataract by the rupture of the inferior zonule. In the experience of the writer it is a fact that it does so in about 15 percent of the cases. Within safe limits it does not do more, else the method of extraction by pressure alone might be more useful. The

writer, in the cases in which subluxation was evident by the rising and movement of the lens, and by the appearance of a dark crescent below the cataract, has not delivered the lens by pressure alone, although this is possible, but has preferred to do so with the aid of traction.

*The manipulation of initial pressure is worthwhile.* The initial-pressure procedure is worthwhile even in the cases in which subluxation does not occur as a result of this maneuver alone, for it aids in the making of observations that give an index of tissue resistance or lack of tissue resistance; the thickness of the cornea and of the iris; of intraocular pressure; of the resistance of the vitreous; of the support of the lens; of the size of the lens and particularly of the nucleus; of the hardness or softness of the lens; and, in general, of the suitability of the eye to be subjected to the manipulations involved in intracapsular cataract extraction. It is a worthwhile, conservative, useful procedure that does not add to the risk of the operation.

*The elevation of the corneal flap and the application of the forceps.* Three directly appositional radial sutures are inserted in the corneoscleral tissue after the incision. The writer has described elsewhere<sup>4</sup> the central suture that is used to retract or elevate the corneal flap in order to obtain a direct view of the iris and of the anterior lens capsule. This maneuver permits the surgeon to observe the efficacy of the size of his incision in relation to the bulk of the lens—if the incision is not large enough it may be increased before the extraction is started. Following Verhoeff's<sup>5</sup> lead, the upper portion of the capsule has been chosen as the most desirable site for the application of the intracapsular forceps, for it is at this point that they can be ap-



plied to the capsule ever so lightly with the least backward pressure, the capsule being in direct view when the corneal flap is lifted. The grasp at or near the upper equator permits of the manipulations to be described later. It seems preferable, to the writer, not to apply the forceps below: first, because of the curvature of the inferior portion of the lens sloping away from the surgeon's grasp; second, because the capsule and the grasp of the forceps cannot be seen clearly through the hazy collapsed cornea; third, in practice an undesirable backward pressure (be it ever so slight) on the lens must be made in order to pick up the capsule; and, lastly, because certain manipulations are not possible with this lower grasp. If a complete iridectomy has been performed, the forceps may be applied to the anterior face of the equatorial region of the lens capsule in practically the same manner as is done by Verhoeff, and the nucleus tilted by gently pressing on the lower equator with the point of the hook just within the limbus. The grasp of the forceps straddles the new equator of the tilted nucleus. If there is no coloboma, the blades of the forceps held in the left hand are slid beneath the iris, to take hold of the anterior face of the equatorial region of the lens capsule at about 10 or 11 o'clock on the lens dial, or the iris may be retracted and a grasp made at 12 o'clock. When a proper hold of the capsule involving a 4- or 5-mm. area has been secured, as may be known because of the direct view of the area, the traction of the central suture on the corneal flap may be released. The turning of the corneal flap by traction suture does not lead to striped keratitis, loss of vitreous, bullous keratitis, corneal opacity, interference with healing, or other undesirable sequelae. The writer has recently raised the flap after the extraction of the cataract, not routinely but

in many cases, to observe the vitreous and the position of the iris. If the latter is not lying between the edges of the incision the use of the repositor is avoided, thus reducing manipulation and trauma to the iris.

#### THE WRITER'S METHOD OF MAKING PRESSURE, TRACTION, AND ROTATION

The forceps having been applied to the lens capsule above, they are lifted slightly vertically and drawn toward the surgeon. One may quickly determine whether the inferior zonule has been ruptured by the initial or preliminary pressure or whether the zonule is still intact. If it has been ruptured, the cataract may be delivered quickly and easily with a slight degree of traction and pressure. If the zonule is still intact, then traction toward the surgeon serves to make the inferior zonule in the vertical meridian taut, point pressure being then applied with the expressor at the 6-o'clock position. Rotation is next made clockwise, so that the forceps with the capsule in their grasp are moved to 2 o'clock, while the point pressure is made directly opposite at 8 o'clock, this being the position in which the zonule is made taut by traction at 2 o'clock. Counterclockwise rotation is then made with forceps moved to the 10-o'clock position, and pressure is made at 4 o'clock. By this coördination of rotation and traction, with its effect of tension on the zonule directly opposite, and pressure, the greatest result with the least effort and trauma is accomplished. At the exact moment of making the point pressure the forceps are held still. If a repetition of this point pressure in the three positions once or twice or possibly a third time does not bring about the desired rupture below, it may be said that the limit of safe traction and pressure has been reached. As to time, it is difficult to determine just

how long one may work safely with the zonule to effect intracapsular delivery. It would seem that five minutes should be sufficient to effect the delivery of the average cataractous lens by coördinated traction, rotation, and pressure measures as described, so that it may finally be slid or wheeled out. If a small hole or tear in the capsule above is accidentally made by the forceps, experience has shown that a second effective hold for the delivery of the cataractous lens, in capsule is possible. The rupture of the zonule, the freeing of the lens, and the time for the removal of the cataract by sliding or wheeling it out through the incision are recognized by experienced and alert surgeons. The lens in the ordinary or average case of cataract may be delivered safely in this manner.

*There is need for caution.* The writer has had a recent experience, which will be referred to later, that caused him to give full value to the manipulations of initial pressure, then to the pressure, traction, and rotation as before described, and to work with the lens in this manner without causing any undue trauma before deciding that the case was not of the ordinary or average resistance or fragility of zonule and before recourse was had to the procedure about to be described.

#### THE WRITER'S METHOD OF INTRACAPSULAR DELIVERY OF CATARACTS WITH RESISTANT, ELASTIC ZONULAR LAMELLAE

If the ordinary or safe degree of the manipulation heretofore described fails to deliver the lens, it would seem improper to continue the same maneuvers that have proved inefficient for the purpose and that might be dangerous if the pressure and traction were increased. In such cases the capsule is also resistant and does not rupture. It became obvious

to the writer when the difficulties of rupturing resistant, elastic zonules were encountered that other steps should be taken to deliver such cataracts in capsule. In such cases the *stripping of the zonule* from the equator of the lens in the area that is exposed to the direct view of the surgeon has been found to be a feasible and conservative process.

*The normal zonule.* The normal zonule in a healthy eye is undoubtedly tough, resistant, and elastic. The writer has never had the opportunity to attempt to remove the normal human crystalline lens in capsule. Such experiences should and will be obtained from eyes, otherwise normal, removed because of the presence of malignant tumors at various ages and on fresh (less than one hour deceased) cadavers. It will most probably be found that the zonule is just as tough, resistant, and elastic as were those of the normal monkey eyes on which the writer tested the qualities of the zonule. He has never encountered, even in the most difficult case of cataract in the human eye, anything approaching the resistance of this normal monkey zonule. There is undoubtedly always some degeneration of the zonule accompanying the development of cataract.

*The zonular lamella.* The term zonular "lamella" is used because, during the writer's intracapsular operations, attachment of the zonule has been observed to be in the form of a membrane or lamella. When a coloboma has been made by complete iridectomy and the lens is lifted vertically and tilted by the combined action of the forceps and hook, the equator may be plainly seen; extending from this, in cases favorable for such observations, is a thin semitransparent, crinkly, glassy, or cellophanelike sheet of zonular lamella. Troncoso,<sup>7</sup> Duke-Elder,<sup>8</sup> Gold-

smith,<sup>9</sup> and others have described the parts of this zonular membrane. Apparently the strongest or most important part is attached to the anterior equatorial area of the lens. Through the zonular membrane, when the lens is lifted, may occasionally be seen the face of the vitreous, and one is enabled to determine whether the vitreous body is relaxed and in a correct posterior position, or whether it is under tension and bulging forward. There is normally more or less space between the equator of the lens and the zonular lamella and the face of the vitreous. In normal cases this space is at least 3 mm. deep when the lens is lifted, and only in such cases may the maneuver of stripping the zonule from the equator of the lens be employed.

*The instrument used in the stripping of the zonule.* With the lens-capsule forceps holding the superior equator of the lens slightly upward in a safe position, the elbow of the lens-expressor hook is applied to the curved surface of the easily visible equator of the lens, and the zonular lamella, which is under tension by being lifted, is thus stripped from the equator. The attachment of the zonule, which previously seemed tough and resistant, now seems to dissolve at the most gentle touch. First a dehiscence is seen, then a disinsertion, and finally a circumferential tearing on rotation occurs. Here again the principle of tension through traction and the application of point pressure for the greatest effect with the least effort is employed. After tearing of the central area of the zonule has started, the lens is rotated clockwise to 2 o'clock on the corneal dial, and the zonule touched or stripped from 12 to 10 o'clock, then counterclockwise rotation is made to 10 o'clock and the zonule touched or stripped from 12 to 2 o'clock. At the exact time of the touching or stripping,

the forceps, having effected the tension by traction and rotation, are held still. A variation that may occur is that of circumferential tearing, which may develop on rotation when once a dehiscence or disinsertion has been started.

*The final delivery of the cataract after stripping of the zonule.* Between 10 o'clock and 2 o'clock the zonule is exposed over an arc of 120 degrees, and is vulnerable, in direct view, to a safe approach of direct interference by the surgeon by means of coördinated traction, rotation, and pressure. When once disinsertion has been effected over these 120 degrees, further tearing generally occurs fairly easily by rotation combined with pressure, inferiorly, through the cornea, opposite the point of traction. One may finally deliver cataractous lenses with resistant zonular lamellas safely, sliding or wheeling them out without continued or excessive pressure and without repeating efforts that are ineffective.

*The discovery of the maneuver of stripping of the zonule.* The maneuver of stripping the zonule was first discovered by the writer when he saw it occur as he was lifting the border of the iris over the equator of the lens with the aid of the elbow of the lens-expressor hook. This observation, and the further tearing of the zonule on rotation of the lens, led him to attempt this stripping of the zonule in other difficult cases.

*The removal of the embryo lens in capsule.* The author's experience in removing the crystalline lens of the 5-day chick embryo is interesting in connection with the latest procedure of stripping the zonule from the equator of the lens when cataract has formed. The reader may be familiar with the research<sup>10</sup> of the writer on the cultivation of crystalline-lens epi-

thelium *in vitro* and the manner of obtaining the specimen of lens epithelium not contaminated by other cells. The writer removed the vitreous, lens, and a ring of pigment from the eye of the 5-day-old chick embryo and by microscopic ( $\times 24$ ) dissection removed the lens from the other tissues by stripping the zonule from the equator of the developing lens. It was perfectly feasible at this stage of development. At the later stages of embryonic development the zonule became more resistant, and it was more difficult to remove the lens in capsule.

*The recent experience which taught the writer caution.* The recent experience that caused the writer to revalue the manipulations which he has used and described for the intracapsular extraction of cataract in eyes with intact zonule was that of the loss of a small amount of vitreous in a manner that seemed directly connected with the stripping of the zonule above. It was the first experience of its kind in a consecutive series of approximately 300 patients operated upon in a period of six years since the maneuver of the stripping of the zonular lamella from the equator of the lens was first used. In the early part of this period final recourse was had to this manipulation only in about 15 percent of the cases. No reference was made to it even though it was shown in motion pictures of the writer's surgery in many places. After the publication of the article<sup>1</sup> dealing with this as a new method, the desire expressed by visiting surgeons to see the method led to its gradually being used more and more even to a slight degree in cases in which delivery might have been effected if the coördinated pressure, traction and rotation had been persisted in for a slightly longer period of time.

In the case referred to the eye was operated upon very recently—in May,

1943. The indications seemed clear for an uncomplicated intracapsular delivery with round pupil. The pupil was well dilated. After a short period of initial pressure, then pressure, traction, and rotation, the inefficiency of the grasp of the forceps on the capsule midway between the upper equator and the central area of the lens became apparent.

The lens in which an immature cataract had developed, was soft; it had a small nucleus which did not tilt well on pressure. The grasp of the capsule away from the equator did not permit the upper pole to be lifted well. The zonule did not rupture easily. Stripping of the zonule above was resorted to at an early stage and under the disadvantage of not having the superior equator properly lifted away from the vitreous body. Separation of the zonule from the equator was effected through an arc of 90 degrees but vitreous presented and finally a small amount was lost upon delivery of the lens in capsule. It can be truthfully reported that this is the first such case in which the vitreous was endangered or lost as a result of this special manipulation. The lessons to be learned are four in number: (1) The decision that the case is a difficult one and that the zonule is too resistant to be delivered safely by pressure, traction, and rotation otherwise should not be made until these maneuvers have been given their full value. (2) The method of stripping the zonule should not be regarded as one which may be applied to all classes of cataract. It should be reserved for the cases which are proved difficult by the failure of preceding manipulations and by observations and should be part of a system of intracapsular cataract extraction. (3) Surgeons who use the method should not plan to do it in a particular case before the operation is in progress. (4) Particular care must be exercised in the place-

ment of the grasp of the forceps. The area of the capsule picked up should be very close to the anatomic equator of the lens. In practice when there is a hard nucleus of the lens which will tilt on pressure, the capsule over the new or adventitious equator of the tilted lens may be straddled and grasped. If the lens is soft, the capsule at the anterior face of the equator may be grasped. This is more easily accomplished in the presence of a complete coloboma by iridectomy. With the round pupil, especial care must be exercised to place the forceps on the peripheral part of the capsule. The observation that the zonule is lifted free from the hyaloid of the vitreous must be made before the stripping of the zonule is begun.

*Preparation for cataract extraction in a difficult case.* If a difficult extraction is anticipated in a certain case, as in a relatively young person, 30 to 50 years of age, who has a resistant zonule, a complete iridectomy may be done, the advantage of the round pupil being given up for the greater ease of operating and the safety of the delivery of the cataract in capsule. If the round-pupil operation has been started and capsule has been grasped in an advantageous position near the upper equator, the grasp should not be relinquished. In such difficult cases the zonule can be safely stripped off, but if the grasp is poorly placed it may be well to give it up, even though a second grasp in the same or different area will expose the weakness of the area of the capsule first grasped and may lead to its rupture at that site. If the important feat of a grasp near the equator is not accomplished and the lens cannot be lifted satisfactorily from the vitreous body, the stripping operation should not be employed. If the iris has interfered too much, a complete coloboma should be

made for the second attempt. There are cases in which it seems desirable to shift the placement of the forceps on the capsule at or near the lower equator and to effect the delivery of the lens by tumbling. However, there is no possibility of using effectively any other maneuvers than those of traction and pressure and limited rotation with the forceps in the lower position. The writer is convinced of the advantages of the grasp at or near the upper equator.

*Results.* A report of statistics of results obtained following the procedures described in the system of intracapsular cataract surgery is in the press and will appear shortly.

#### SUMMARY AND CONCLUSIONS

The development of a system of intracapsular cataract surgery by which particular techniques are adapted to the case in hand has been described. The basis of the system is concerned chiefly with the condition of the lens capsule, cortex, zonule, and vitreous. Observations made before and during the progress of the operation guide the surgeon in his selection of the procedure to be employed. An ineffective procedure is not repeated. The application of the system has been made not only to the eyes with cataracts in which the zonule is intact but also to those in which the lens is luxated or subluxated. The description of procedures applicable to the latter more or less follows the literature, except for the suggestion that at times it may be necessary to strip off the resilient, resistant portion of zonule that is present in the case of young persons who have congenital malformations.

The methods used in intracapsular extraction in cases with intact zonules represent a further development of the procedures that have been previously de-

scribed by the writer. The cases are divided into three classes: First, a small group of those in which the zonule is fragile, and traction or pressure alone or a combination of them may be employed for the relatively easy delivery of the cataract. Second, the large group of cases in which the zonule has the average resiliency and resistance and in which an average degree of pressure, traction, and rotation of the lens clockwise and counterclockwise should succeed. The exact method of using these procedures is described. Third, a small percentage of cases in which the zonule exhibits greater-than-the-average degree of resistance and in which, when this is recognized, the maneuver of stripping off the zonule is resorted to after the other procedures have been used within the limits of safety. A particular case is described

which taught the need for caution. It is recognized that in all cases of cataract formation there is more or less degeneration of the zonule. It is worthwhile to have a procedure which is effective and safe, when used properly, when others have failed. The conditions under which the manipulations of stripping off the zonule may be employed are described in detail. A report of statistics or results obtained following the procedures described in the system of intracapsular surgery is in the press and will appear shortly. The author's procedures for intracapsular surgery have been described before, but not in the present systematic form. It was said before that they were feasible. Now it is reported that they are conservative and desirable.

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# A COMPARISON OF THE OCULAR REACTIONS OF PIGMENTED AND ALBINO RABBITS TO NORMAL HORSE SERUM\*

INTRAOCULAR FOLLOWED BY INTRAVENOUS INJECTION

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The purpose of this report is fourfold:

1. To compare ocular reactions in pigmented and albino rabbits.
2. To use an allergic mechanism consisting of intraocular followed by intravenous injection of normal horse serum.
3. To compare effects observed at three different intervals of time intervening between intraocular and intravenous injections: 1, 7, and 14 days.
4. To study the histopathologic features of the injected and fellow eyes at variable periods after the intravenous injection.

Schlaegel and Davis<sup>1</sup> have shown that a close resemblance to the histopathologic picture of sympathetic ophthalmitis can be produced in rabbit eyes receiving an injection of normal horse serum. This report is a continuation of a study of the reaction of the rabbit eye to normal horse serum, using another allergic mechanism and employing a comparison of the reaction in pigmented and albino rabbit eyes.

Seegal and Seegal<sup>2</sup> showed that "Eyes which had been sensitized with a foreign protein uniformly failed to respond to the intravenous injection of the homologous substance until at least the fifth day. Although slight inflammatory response could be produced in a few animals on the sixth to the tenth day after sensitization, it was quite evident from the majority of experiments that the eye response reached a maximum from the tenth to the fifteenth day or even later after local sensitization."

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The report of Seegal and Seegal considered only the gross ocular reactions. This report includes both gross and microscopic studies.

The comparison of pigmented and albino rabbits was undertaken in an attempt to throw some additional light on the pigment-allergy theory of sympathetic ophthalmia. A minor purpose was to compare results with those of Riehm<sup>3</sup> who concluded that horse serum absorbed from one eye produced an elective sensitivity in the fellow eye, resulting in uveitis in pigmented rabbits but not in albinos. This conclusion was based on experiments with 18 rabbits, 2 of which were albinos. His method was to drain the anterior chamber of the right eye and to replace the aqueous with the same amount of horse serum. The point of the needle was inserted into the root of the iris and 0.25 c.c. to 0.50 c.c. of horse serum was injected. He used various procedures in each of the 18 animals. As an example of the type of procedure and of the results obtained, there follows a report on one of his pigmented and on one of his albino rabbits.

His pigmented rabbit number 144 was injected, as herein described, on the 1st, 12th, 13th, and 14th days, with a total of 1.05 c.c. of horse serum. An intravenous injection of 20 c.c. of horse serum was given on the 40th day; an iritis developed and reached its height on the 47th day. The periphery of the choroid was invaded by foci which gradually became pigmented and resembled fine spotted chorioretinitis. On the 139th day he gave a second intravenous injection of 20 c.c. which was followed in 7 days by a recur-



rent iritis and cloudy cornea. On the 155th day, under atropine mydriasis, he observed at least 100 rather large and new white foci of the choroid.

His albino rabbit number 147 was injected in the right eye on the 1st, 11th, 13th, 15th, 17th, 22d, 46th, and 57th days.

applications of 2 drops of 4-percent butyn. A 27-gauge needle was inserted 5 mm. behind the limbus at the 12-o'clock meridian. One tenth of a cubic centimeter of normal horse serum was then injected into the vitreous.

Three series of rabbits were used. In

TABLE 1

GROSS LIVING AND MICROSCOPIC RESULTS OF THE INJECTION OF NORMAL HORSE SERUM THROUGH THE CILIARY REGION OF THE RIGHT EYE FOLLOWED BY AN INTRAVENOUS INJECTION *one day* LATER

Rabbit Number P=pigmented	Gross Reaction* after Intraocular		Gross Reaction* after Intravenous		Days from Intrav. till Enu- cleation	Microscopic Study		
						Right Eye		Left Eye
	O.D.	O.S.	O.D.	O.S.		Degree of Infiltration**	Giant Cells†	
P738	+	0	+	0	$\frac{1}{2}$	Normal		Not done
P750	+	0	+	0	1	Normal		Not done
P760	+	0	+	0	2	Normal		Not done
P759	+	0	+	0	7	2+	0	Not done
P758	+	0	+	0	14	4+	2+	Not done

\* +=slight reaction as sluggish pupillary response and slight congestion at the injection site.

++=moderate congestion and slight iritis.

+++ =pronounced congestion, chemosis, and more iritis.

++++ =extreme congestion, chemosis, strands of exudate on iris and in pupil.

0=no change in eye.

\*\* 1+=minimal cellular infiltration of uvea or upon optic disc—always by monocytes, often by lymphocytes and epithelioid-like cells also.

2+=cellular infiltration by monocytes, lymphocytes, and epithelioid-like cells filling the normal thickness of the choroid.

3+=distension of choroid by cellular infiltration sometimes including giant cells.

4+=distension of choroid to several times its normal thickness always including giant cells and many epithelioid-like cells.

† 1+=one or two giant cells in routine six sections.

2+=three to 10 giant cells in routine six sections.

3+=over 10 giant cells in routine six sections.

The total injection of horse serum was 2.5 c.c. During this treatment he failed to find any changes in the left eye. After 20 c.c. of intravenous horse serum was injected on the 111th day, he noticed only conjunctival injection and spastic pupil in the left eye.

#### PROCEDURE

For this report the following procedure was followed: All rabbits were examined grossly at the start with the aid of a flashlight, and those with eyes inflamed from any cause were discarded. The right eyes were anesthetized by three

the first series (table 1) 5 pigmented rabbits received an intraocular injection, followed 24 hours later by an intravenous injection of 1.0 c.c. of normal horse serum. The eyes were then enucleated at variable periods from one-half to 14 days. This series was considered a test group, since from the work of Seegal and Seegal we did not expect to obtain a reaction.

The second series (table 2) was composed of 12 pigmented and 12 albino rabbits. (Some of the rabbits died and were replaced by rabbits treated in the same manner.) The intravenous injection

followed the intraocular injection by seven days. At each of 6 different intervals from one-half to 21 days, 2 pigmented and 2 albino rabbits were killed and their eyes enucleated.

The third series (table 3) also was

right and left) of series 2 and 3 which were apparently normal in the routine 6 sections were studied further in 6 more sections cut in different areas. To ascertain correctly the absolute amount of infiltration, serial sections should be made,

TABLE 2

GROSS LIVING AND MICROSCOPIC RESULTS OF THE INJECTION OF NORMAL HORSE SERUM THROUGH THE CILIARY REGION OF THE RIGHT EYE FOLLOWED BY AN INTRAVENOUS INJECTION *one week* LATER

	Rabbit Num- ber	Gross Reaction* after Intra- ocular		Gross Reaction* after Intra- venous		Days from Intrav. till Enu- cleation	Microscopic Study			
		O.D.	O.S.	O.D.	O.S.		Right Eye		Left Eye	
							Degree of Infiltra- tion**	Giant Cells†	Degree of Infiltra- tion**	Giant Cells†
Pigmented	P999	+	0	+	0	$\frac{1}{2}$	Normal		Normal	
	P746	+	0	+	0	$\frac{1}{2}$	1+	0	Normal	
	P532	+	0	++++	0	1	2+	0	1+ #	0
	P1000	+	0	+	0	1	1+	0	1+ #	0
	P595	+	0	++++	0	2	2+	0	1+ #	0
	P904	+	0	+	0	2	1+	0	Normal	
	P531	+	0	+++	0	7	3+	0	Normal	
	P909	+	0	+	0	7	2+	0	Normal	
	P785	+	0	+	0	14	1+	0	Normal	
	P910	+	0	+	0	14	2+	2+	1+ #	0
	P529	+	0	+	0	21	2+	0	Normal	
	P905	+	0	+	0	21	1+	0	1+ #	0
Albino	A754	+	0	+	0	$\frac{1}{2}$	Normal		Normal	
	A175	+	0	+	0	$\frac{1}{2}$	1+	0	Normal	
	A739	+	0	+	0	1	1+ #	0	1+ #	0
	A110	+	0	+	0	1	1+	0	1+ #	0
	A769	+	0	+	0	2	1+ #	0	Normal	
	A108	++	0	++	0	2	1+	0	Normal	
	A747	+	0	+	0	7	1+ #	0	1+ #	0
	A115	+	0	++	0	7	2+	0	Normal	
	A748	+	0	+	0	14	1+	0	Normal	
	A141	+	0	++	0	14	3+	1+	1+ #	0
	A736	+	0	++	0	21	1+	0	1+ #	0
	A103	+	0	++	0	21	1+	0	Normal	

\*, \*\*, † = Cf. table 1.

# = Eyes normal in routine six sections but positive in six extra sections.

composed of 12 pigmented and 12 albino rabbits. (In this group also some of the rabbits died and were replaced.) The procedure differed from that of series 2 only in that the interval between intraocular and intravenous injection was 14 days.

In all three series the gross reactions were studied the days following the intraocular and intravenous injections. Routinely, six sections stained with hematoxylin and eosin were made of both right and left eyes. But all eyes (both

but it was felt that in this experiment such a procedure would not be worth the effort required.

#### GROSS REACTIONS

After the intraocular injection, the right eyes as a rule showed only a minimal reaction such as would be expected to result from the trauma of injection. However, a few of the right eyes responded to a degree greater than the expected minimum. This may have been

due to the activation of a latent ocular infection or to a transient infection incident to the injection.

After the intravenous injection in series 1, there was no increase in the minimal response. In series 2, one third of the animals, and, in series 3, more than one half of the animals developed a more

substance until the fifth day and the reaction is maximum at about 14 days.

Further evidence that 14 days is a period of maximum allergic response is seen in the high percentage of rabbits which died in convulsions a few minutes after the injection. One fourth of the animals in series 3 died in this manner as

TABLE 3

GROSS LIVING AND MICROSCOPIC RESULTS OF THE INJECTION OF NORMAL HORSE SERUM THROUGH THE CILIARY REGION OF THE RIGHT EYE FOLLOWED BY AN INTRAVENOUS INJECTION *two weeks* LATER

	Rabbit Num- ber	Gross Reaction* after Intra- ocular		Gross Reaction* after Intra- venous		Days from Intrav. till Enu- cleation	Microscopic Study			
		O.D.	O.S.	O.D.	O.S.		Right Eye		Left Eye	
							Degree of Infiltra- tion**	Giant Cells†	Degree of Infiltra- tion*	Giant Cells†
Pigmented	P918	+	0	++	0	$\frac{1}{2}$	3+	0	1+ #	0
	P907	+	0	+	0	$\frac{1}{2}$	2+	0	Normal	
	P914	+	0	+	0	1	1+	1+	Normal	
	P937	+	0	+	0	1	2+	0	Normal	
	P916	+	0	++	0	2	4+	2+	Normal	
	P915	+	0	+	0	2	1+ #	0	Normal	
	P936	+	0	++	0	7	1+	0	Normal	
	P935	+	0	+	0	7	1+	1+	1+ #	0
	P923	+++	0	+	0	14	1+	0	1+ #	0
	P922	+	0	+	0	14	1+	0	Normal	
P955	+	0	+++	0	21	1+	0	1+ #	0	
P921	+	0	++	0	21	1+	0	Normal		
Albino	A135	+	0	++	0	$\frac{1}{2}$	3+	0	Normal	
	A111	+	0	++	0	$\frac{1}{2}$	2+	0	Normal	
	A829	++	0	++	0	1	1+	0	1+ #	0
	A828	+	0	++	0	1	1+ #	0	Normal	
	A187	++	0	++++	0	2	4+	3+	Normal	
	A812	+	0	++	0	2	2+	0	Normal	
	A836	+++	0	+++	0	7	1+	0	1+ #	0
	A142	+	0	+	0	7	1+	0	1+ #	0
	A807	++	0	++++	0	14	2+	0	2+	0
	A146	+	0	+	0	14	1+	0	1+	0
	A162	+	0	+	0	21	1+	0	Normal	
	A116	+	0	+	0	21	1+	0	Normal	

\*, \*\*, †=Cf. table 1.

#=Eyes normal in routine six sections, but positive in six extra sections.

than minimal reaction. This increased reaction was found more frequently in the right eyes of albino rabbits than in the right eyes of pigmented rabbits. The reason for this may have been the greater visibility of congestion in albino irides.

Thus we confirm, in our limited series, the conclusions of Seegal and Seegal that rabbits fail to respond *grossly* to the intravenous injection of the homologous

compared to one eighth of those in series 2 and none in series 1.

In all three series the left eyes consistently failed to show gross evidence of reaction.

#### MICROSCOPIC RESULTS

In this report attention is focused on the histopathologic features.

*Series 1* (table 1). The number of

rabbits is inadequate. The right eyes were free of cellular infiltration until seven days after the intravenous injection. The response at 7 days was moderate and the one at 14 days pronounced.

A detailed report of the histopathologic findings will not be given, as they were very similar to those previously

one pigmented (half of those enucleated after 12 hours) were found to have cellular infiltration of the uvea. The degree of cellular infiltration was more pronounced in the pigmented group.

All *left* eyes were apparently normal in the routine six sections, but further study in six more sections revealed a

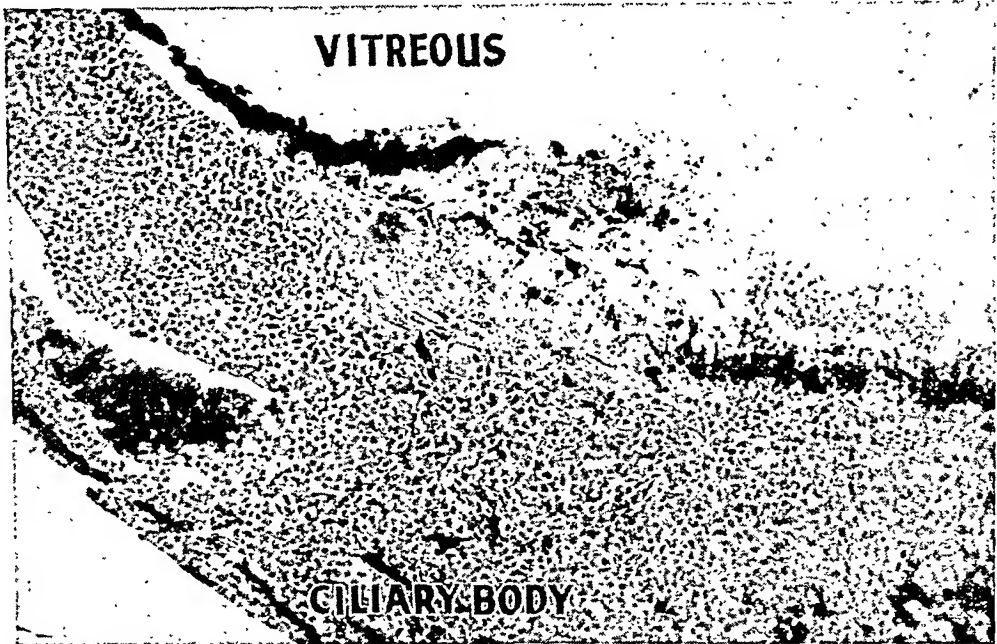


Fig. 1 (Schlaegel). The ciliary body is swollen by a mononuclear infiltration to over twice its normal size. A nodule of epithelioid-like cells (including a small giant cell) is bursting through the pigment epithelium into the vitreous. Part of a dilated and engorged vein is on the left.

reported.<sup>1</sup> P758 was a typical four-plus reactor (fig. 1). There was a dense uveal infiltration which swelled the choroid to several times its normal thickness. The cells were mainly monocytes with a fair percentage of lymphocytes, plasma cells and epithelioid-like cells, and a few giant cells. There was slight perivascular infiltration of the sclera. The retina was disorganized and had gliosis on its surface. The pigment epithelium was scalloped owing to ballooning of its cells, and the iris was densely infiltrated in its posterior half.

*Series 2* (table 2). In this series all right eyes but that of one albino and of

slight uveal infiltration in 5 of the 12 pigmented and in 5 of the 12 albinos.

Guillery<sup>4</sup> in his work using tuberculoxins as a sympathogenic agent has said that by studying all sections he has yet to find an experimental animal with no findings in the secondary eye. It has also been the experience of pathologists that serial sections will often make possible a diagnosis of sympathetic ophthalmia in enucleated human eyes when a few routine sections fail to show the characteristic change.

It must be kept in mind, however, that the infiltration in the left eyes was very slight. Also, in a study of a series of un-

treated apparently normal rabbit eyes, such an infiltration was occasionally found. We cannot conclude, therefore, that all of the slight infiltrations in either right or left eyes were due to a reaction to horse serum.

*Series 3* (table 3). In this series the microscopic cellular infiltration as well as the gross clinical reaction reached its

tigen-antibody complex after 14 days.<sup>2</sup> The stimulating agent is probably the lipoids or their derivative fatty acids.<sup>5, 1</sup>

It is interesting that in series 3 both the gross and microscopic reactions were no more severe than if no intravenous injection had been made.<sup>1</sup> Apparently the intravenous injection was a superfluous addition to the allergic reaction that occurs



Fig. 2 (Schlaegel). The folds between the densely infiltrated ciliary processes are filled with an exudate consisting mainly of epithelioid-like cells.

height. The severity of the infiltration in the pigmented and albino subgroups was equal.

It has already been shown that rabbits receiving only an intraocular injection of normal horse serum fail to respond until after about 14 days.<sup>1</sup> This "incubation period" may depend on the time necessary for the vitreous lipase<sup>5</sup> to cause sufficient change in the horse serum to release the active exciting agent. Or it may depend on an allergic reaction as a result of the development of an an-

after 14 days in eyes receiving only an intraocular injection. However, in both series 1 and 2 definite cellular infiltration appeared before 14 days had elapsed. It is thus probable that in the first two series the activation of the horse serum in the right eyes was hastened by the allergic response to intravenous horse serum. Although an allergic reaction was not observed grossly in series 1, there may have been an intraocular change undetected by external examination.

Of the left eyes, 4 of the 12 pigmented

and 5 of the 12 albino rabbits had a slight uveal infiltration. Although the infiltration was minimal, it was of the same character as an infiltration of similar degree in the right eyes. It consisted of one or two small nodules of monocytes and lymphocytes in the uvea and had none of the features of tubercular granulation tissue seen in the right eyes of severe reactors.

#### DISCUSSION OF HISTOPATHOLOGY

Polymorphonuclear leucocytes were uniformly absent from all the sections studied. This was probably due to a change of the normal alkaline condition of the eye to the acid side of neutrality as a result of the first intraocular injection.<sup>1</sup> Polymorphonuclears predominate when the tissues are alkaline but are replaced by mononuclear cells when the tissues become acid.<sup>7</sup>

There are two histopathologic features of the reaction of the rabbit eye to normal horse serum which we failed to discuss in our previous paper:

1. E. Fuchs<sup>8</sup> pointed out that in sympathetic ophthalmia a cellular infiltration consisting mainly of epithelioid cells is seen to break into the vitreous from the ciliary body, filling the spaces between the folds of the corona ciliaris. Such a response was observed in our intense reactors (fig. 2). The filling-in of the folds is another fact further<sup>1</sup> differentiating the reaction to normal horse serum from that of panophthalmitis, for in panophthalmitis the cells lodge at the tips of the corona.

2. E. Fuchs<sup>8</sup> also described a bursting of epithelioid cells

from the choroid into the subretinal tissues and even into the vitreous. The boundaries of the cells become sharper and assume a spindle shape. They may grow to form long thin strands. These cells are distinguished from true connective tissue because they stain yellow with Van Gieson stain, whereas connective tissue stains red. Such a phenomenon was observed in a few of the severe reactors (fig. 3).

Sabin, Doan, and Forkner<sup>6</sup> have pointed out that the epithelioid cell is not

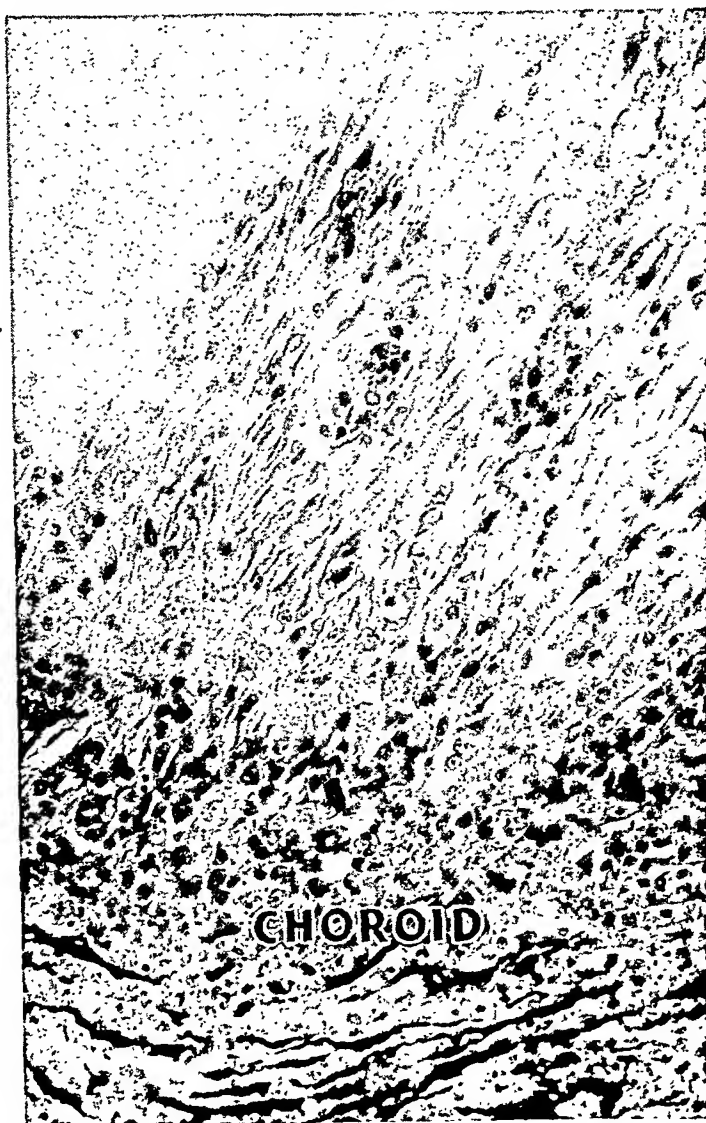


Fig. 3 (Schlaegel). Elongated spindle-shaped cells are growing out from the choroid into the vitreous.



the immediate reactor to active chemical substances. Preceding its appearance there is a maturation of new young monocytes. They found the epithelioid cells appearing by the fourth day.

In this experiment epithelioid-like cells were seen by the fourteenth day in series 1, after the first day in series 2, and after

by supravital staining) are more typical in appearance. It may be that the cells previously described, and many seen in the sections of this experiment, were young and in the stage of transformation from monocytes to epithelioid cells.

Although epithelioid-like cells were usually present, they were not always

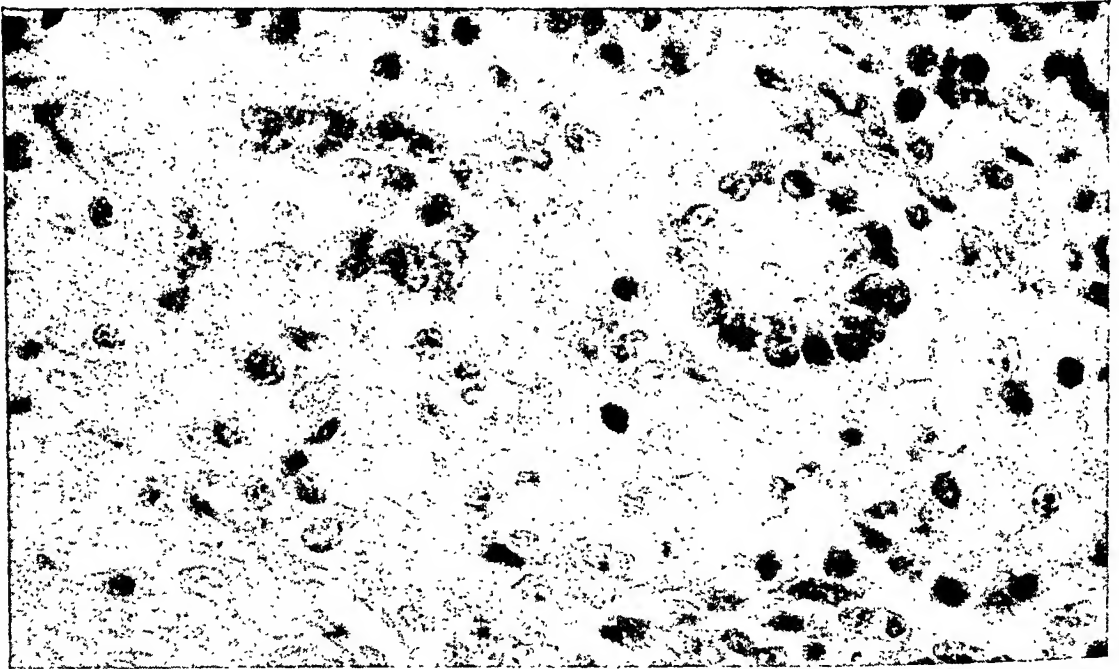


Fig. 4 (Schlaegel). (Albino 187.) Two giant cells (one foreign-body type and one Langhans type) are seen lying in the choroid surrounded by a diffuse infiltration consisting mainly of epithelioid-like cells. The giant cells have engulfed cellular debris.

one-half day in series 3. These time intervals are measured from the time of intravenous injection. The total period from the time of the first injection into the right eye was more than four days in all three series. The epithelioid-like cells were found in greatest number early in the third series.

In a previous paper<sup>1</sup> we defined the term epithelioid-like cell and used it for cells appearing like epithelioid cells except that the nucleus was usually round instead of the characteristic bent shape. In this series the epithelioid-like cells (a term we shall continue to use because we do not have proof that they are epithelioid cells

found and were seldom present in great numbers except in eyes with a three- or four-plus reaction. E. Fuchs<sup>8</sup> pointed out that epithelioid cells are often difficult to find and may possibly be lacking entirely in sympathetic ophthalmia. He also noticed that they were more numerous when the cellular infiltration was intense.

A comparison of the giant cells in the pigmented and albino groups failed to reveal any essential difference. Both foreign-body and Langhans types were present. In the pigmented group these cells had phagocytosed pigment granules, whereas in the albino group other debris was present in the cytoplasm (fig. 4). In



regard to the scarcity of giant cells in the infiltration in this experiment, it should be pointed out that Fuchs stated they were present in but one half of his cases of sympathetic disease.

#### COMMENT

Upon comparing the results of this ex-

periment with those of a method previously reported,<sup>1</sup> in which the rabbits were first sensitized by intradermal injections and then injections were made into the right eye, we find that the degree of cellular infiltration is less and the number of giant cells is fewer.

right eye. Also, the gross reaction in the first four albino rabbits was very minimal. Our premature impression, therefore, was that albino rabbits were not going to respond to the intraocular followed by an intravenous injection of normal horse serum. However, upon doubling the number of rabbits and upon a search in

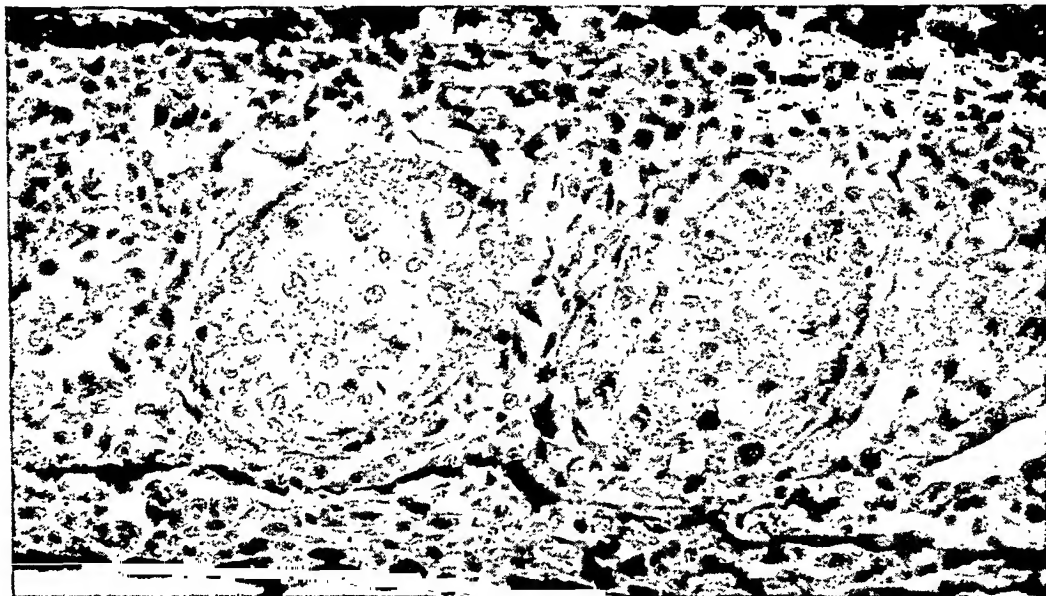


Fig. 5 (Schlaegel). Two nodules of epithelioid-like cells are lying in a heavy mononuclear infiltration of the choroid.

periment with those of a method previously reported,<sup>1</sup> in which the rabbits were first sensitized by intradermal injections and then injections were made into the right eye, we find that the degree of cellular infiltration is less and the number of giant cells is fewer.

The conclusion of Riehm,<sup>3</sup> that horse serum absorbed from one eye produces an elective sensitivity in the fellow eye resulting in uveitis only in pigmented rabbits, has been much quoted. This conclusion was based on gross and ophthalmoscopic findings and apparently did not include microscopic study. In series 2 of this experiment, the first four albino right eyes studied were found to be normal, as compared to only one normal pigmented

additional sections we found this presumption to be untrue.

Although the cellular infiltration in the left eyes was minimal, there was an equal response in pigmented and albino rabbits. If we had used horse serum in as large doses and with as repeated injections as did Riehm, it is possible that the response in the left eyes would have been more intense. Although no essential difference was found in the reaction in pigmented and albino rabbit eyes, it must not be concluded that the pigment-allergy theory is discredited. The procedure here followed is, most probably, far removed from the actual etiologic mechanism of sympathetic ophthalmitis. Also the involvement of the left, or sympathizing eyes, was far too

slight to be conclusive. The pigment-allergy theory has much factual backing, and pigment very likely plays some role in the development of sympathetic ophthalmia.

However, tubercular granulation tissue such as is seen in sympathetic ophthalmia has been shown to be due to the stimulation of some lipoids or their derivative fatty acids.<sup>6</sup> Therefore, it is improbable that melanin is the actual exciting agent since as far as we know it does not contain lipoids or fatty acids.<sup>9</sup>

### CONCLUSIONS

1. Gross and microscopic ocular reactions were essentially equal in pigmented and albino rabbits.

2. The allergic mechanism of intraocular followed by intravenous injection of normal horse serum is less effective in producing gross and microscopic results than the method of sensitization by intradermal injection prior to injection made into the right eye.

3. Gross and microscopic reactions were most pronounced when the intravenous followed the intraocular injection by 14 days.

4. The microscopic picture of the injected eyes of severe reactors bore a close resemblance to that of sympathetic ophthalmia. The uveal infiltration in the non-injected eyes was very slight but was present in 40 percent of the cases.

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## PRESENT LIMITS OF GONIOSCOPY\*

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After having been a scientific hobby of a few investigators for about 30 years, gonioscopy has finally become a routine method of examination in many clinics and private offices. A wealth of new observations has been made and recorded in the literature.<sup>1</sup> To take inventory of the new knowledge, as far as it pertains to the glaucomas, could be done in several ways. We have chosen to do it by stressing the present limits of gonioscopy, limits as they apply to the physical procedure, to the availability of definite, characteristic findings and to the interpretation of such findings. Such a presentation may serve to define the present-day status of gonioscopic knowledge more briefly and concisely than would a discussion of all the established facts.

Gonioscopy has been expected to give information with regard to: (1) the patency or accessibility of the angle of the anterior chamber; (2) the function or permeability of the corneoscleral trabeculum; (3) involvement of the anterior portion of the ciliary body in an inflammatory or neoplastic disease of the uvea; (4) abnormal tissue-elements or foreign bodies in the angle; (5) how and why surgical operations in the region of the angle have succeeded or failed to normalize the intraocular pressure.

In the glaucomas gonioscopy is chiefly concerned with items 1, 2, and 5. The part played by peripheral anterior synchiae (PAS) in the mechanism of the glaucomas has certainly been greatly elucidated and clarified by the advent of gonioscopy, but it would not be true to

say that gonioscopy has "straightened us around" on that subject. Even in the pregonioscopic era we knew from pathologic as well as clinical observations that among the so-called primary glaucomas there are: (1) cases in which closure of the entrance to the chamber angle by contact between iris and lateral angle wall constitutes the primary pressure-elevating mechanism, and (2) cases in which the intraocular pressure becomes and remains elevated in the presence of an entirely open angle. It was also known that in some of the cases of the latter group during the course of the glaucoma PAS can develop which have not played a part in the original pressure-elevating mechanism but may aggravate the situation. While it is true that the names, "congestive" or "inflammatory" on the one hand and "chronic simple glaucoma" on the other hand did not express the principal difference between the two types of glaucoma, the existence of such a difference was fully realized in the pregonioscopic era. Our enthusiasm over the classification of the so-called primary glaucomas into the narrow-angle and the wide-angle type (O. Barkan), which terms express the principal difference between the two types much more clearly, should not make us forget that their existence had been postulated from anatomic as well as clinical evidence long before anybody ever saw the chamber angle in a living eye.

With regard to the narrow-angle type, it may be of interest to hear that W. Czermak<sup>2</sup> in 1897 gave a fairly accurate description of its mechanism: "Through progressive senile increase in the volume of the lens and perhaps also of the ciliary processes . . . the anterior chamber of the senile eye becomes shallow, which consti-

\* From the Illinois Eye and Ear Infirmary (Chief of Staff, Dr. Harry S. Gradle). Read before the Chicago Ophthalmological Society, March 15, 1943.

tutes a predisposition to glaucoma. If the pupil dilates under the influence of a mydriatic or in the dark as through stimulation of the sympathetic, the crowded-together root of the iris comes in contact with the posterior surface of the cornea and the connection between anterior chamber and chamber angle is closed off. By continued action of Schlemm's venous plexus the aqueous is siphoned out of this closed-off pocket. The pressure in it drops while it rises in the remainder of the anterior chamber. Thus the root of the iris . . . is sucked or, by the pressure of the aqueous in the posterior chamber, pressed into the angle."

The concept of a temporary contact between iris and lateral angle wall as a cause of acute rises of the intraocular pressure in anatomically predisposed eyes received support from the clinical studies of Gröenholm,<sup>3</sup> Seidel and Serr,<sup>4</sup> and, finally, was proved to be correct by H. S. Sugar's gonioscopic observations<sup>5</sup> of the actual occurrence of the contact immediately before the rise of intraocular pressure. Gonioscopy thus has played an important part in establishing the mechanism of narrow-angle glaucoma. Practically, it has enabled us to determine whether or not in a given case the anatomic predisposition—namely the narrowness of the entrance to the angle—is present. This is an important point, since narrowness of the angle entrance is not always associated with all-over shallowness of the anterior chamber.

The gonioscopist sometimes finds it difficult to answer the question, whether or not an eye with a certain degree of narrowness of the angle is actually in danger; that is, whether the angle-crowding that is likely to occur in normal life is sufficient to lead to temporary closure of the entrance to the angle. He tries to answer this question by investigating (after Sugar) the effects (1) of moderate mydriasis produced by drugs, and (2) of

accommodation. If both of these two angle-crowding factors do not bring the iris in contact with, or very close to, the lateral angle wall, the gonioscopist is tempted to consider the degree of angle narrowness as innocuous and the patient not in danger. The question is whether we actually know and are able to reproduce at will all natural angle-crowding factors. Besides emotion (through factors other than mydriasis) and upper respiratory infections which were considered by Sugar in his work on the mechanism of acute glaucoma,<sup>5</sup> there may be still other angle-crowding factors. While the general opinion seems to be that eyes with potential or definitely established narrow-angle glaucoma differ only in one respect from the normal eye—namely, in their anatomic angle configuration—there is a remote possibility that the anterior uvea in these eyes does undergo sudden increases in volume to a greater extent than does the normal eye. In a number of cases in which artificial mydriasis plus accommodation did not produce closure of the entrance to the angle and therefore no embarrassment of the intraocular pressure, weeks or months later a spontaneous rise of the intraocular pressure occurred which could not be attributed to any *known* angle-crowding factor. The practical conclusion should be that the distinction between dangerously or innocuously narrow angle entrances cannot always be made with absolute certainty and that any eye with marked narrowness should be considered as being in danger.

To what extent the angle, in established narrow-angle glaucoma, has become closed off by permanent peripheral anterior synechiae (which develop if the contact is not interrupted fairly promptly by miotics, surgery, or spontaneously) can usually be determined with great accuracy. Difficulties arise in the extreme degrees of shallowness of the anterior chamber in which one usually finds rela-

tively small and flat corneas combined with an extreme forward-position of the iris-lens diaphragm. In gonioscopic lingo, in these cases, we are not able to get over the iris hump. It seems unlikely that by a further modification of the contact lens some of these angles could be rendered visible. As stated by Sugar, the lens of type A seems more suitable for the examination of such shallow chambers than the lens of type C. Still, certain angles have to be described as being too shallow for gonioscopy and the question whether there is a narrow cleft leading down to the apex of the angle or whether there are peripheral anterior synechiae has to be left unanswered. We have found that when the PAS reach considerable extent in meridional direction the iris hump does become less pronounced, the iris taking on the shape of a chord where it used to be an arc. Thus the presence of flatter, straighter iris sectors in eyes with very shallow anterior chambers is suggestive of PAS in those sectors.

The presence of corneal edema is no insuperable obstacle since by massage with a glass rod, according to Larsson,<sup>6</sup> or by the instillation of glycerine (Cogan<sup>7</sup>), a portion of the cornea can be cleared sufficiently to permit gonioscopy.

The close parallelism between closure of the angle and elevation of the intraocular pressure which has been found in innumerable instances in which before the formation of the PAS the intraocular pressure was normal, constitutes weighty evidence in favor of the concept that the human eye depends largely upon the trabeculum-canal-of-Schlemm mechanism for maintenance of a normal intraocular pressure. Because of the general importance of this concept the closeness of this parallelism between closure of the angle and intraocular pressure in eyes without any artificial new outlet for the intraocular fluid has been the subject of special investigation. An apparent lack of paral-

lelism is seen occasionally in eyes with acute congestive glaucoma in which an iridectomy completely and permanently controls the intraocular pressure although most of the chamber angle seems to be closed. A similar situation is found in a very small percentage of the cases which, as a result of prolonged absence of the anterior chamber after cataract operations, have developed extensive PAS. Such exceptions from the general rule of parallelism have been explained by Sugar<sup>8</sup> as being due to minute iris incarcerations which, while not big enough to cause any visible permanent gaps in the operative incision associated with gross blebs in the overlying conjunctiva, allow a sufficient amount of filtration to keep the intraocular pressure at a normal level. In some of these cases Sugar was able to "raise" minute blebs by massage of the eye. The presence and patency of such minute subconjunctival fistulas is difficult to prove conclusively. There have been a number of histologic reports indicating their presence where they had not been seen nor expected clinically. On the other hand, small iris incarcerations in the presence of closed angles very often fail to control the intraocular pressure permanently, especially if in the eye in question the natural channels of outflow were insufficient before the PAS formed. Whatever the role of small iris incarcerations may be, there are cases of narrow-angle glaucoma which have been controlled by iridectomy without iris incarceration although more than three quarters of the angle appeared to be closed. To us these cases seem to indicate that in narrow-angle glaucoma in which the normal channels of outflow function normally until the entrance to the angle becomes obstructed or PAS form, a small accessible portion of the trabeculum is sufficient for maintenance of normal intraocular pressure. It also seems possible that in such eyes filtration takes place through tiny

gaps in the PAS as well as around the synechiae into open-angle pockets.

All in all, gonioscopy gives satisfactory explanations for most of the phenomena observed in narrow-angle glaucoma. The name seems to have been well chosen, the closure-inviting narrowness of the angle being the main if not the sole cause of the glaucoma. The term "wide-angle glaucoma" has no such positive meaning; it refers to a negative characteristic of this large and very heterogeneous group of glaucomas; namely, the absence of any visible obstacle to the passage of aqueous into the trabeculum. What little there is in the way of positive characteristics of this group, could not be included in its name. Here the limits of gonioscopic knowledge are very apparent. In the absence of any obstruction within the angle the gonioscopist's natural move was to look for signs of decreased permeability of the corneoscleral trabeculum. O. Barkan even went so far as to use the term "trabecular" as a synonym for wide-angle glaucoma and as the counterpart to narrow-angle or iris-block glaucoma, although he does mention, under the general heading of trabecular glaucoma, a secretory or neurogenic variety.

The gonioscopic recognition of impaired function of the corneoscleral trabeculum has proved most difficult. In our work on the visualization of the canal of Schlemm by drawing blood into it,<sup>9</sup> we observed a few cases of advanced wide-angle glaucoma in which the trabeculum seemed definitely less transparent than normally, which may have been a sign of sclerosis. Bangerter and Goldmann<sup>1</sup> describe veiling of the anterior surface of the ciliary body in some of their wide-angle glaucomas, which may have meant lessened permeability of the uveal portion of the trabeculum that overlies the ciliary body. This veiling, unless it is very pronounced, may be difficult to recognize and to distinguish from the normal. We

have seen it, but it is rare.

Gonioscopy has been responsible for a revival of or renewed interest in the pigment-block theory of some glaucomas. A considerable percentage of all wide-angle glaucomas show excessive pigmentation of the trabeculum, but in the majority of them the degree of trabecular pigmentation varies within the same wide limits as in nonglaucomatous eyes of the

TABLE 1

RELATIVE INCIDENCE (PERCENTAGE) OF THE VARIOUS DEGREES OF TRABECULAR PIGMENTATION IN NONGLAUCOMATOUS AND WIDE-ANGLE GLAUCOMATOUS EYES OF SUBJECTS OVER 40 YEARS OLD

Degree of Pigmentation	Controls		Primary Wide-Angle Glaucoma	
	Iris blue or gray	Iris hazel or brown	Iris blue or gray	Iris hazel or brown
None	59	9	16	15
Slight	29	58	24	30
Moderate	11	32	40	32
Excessive	0	0	20	23

same age and racial group. Table 1 shows the degree of pigment infiltration of the trabeculum in 200 nonglaucomatous and 150 wide-angle glaucomatous eyes of individuals over 40 years of age.\* While these numbers are probably too small and the estimation of the pigment content by gonioscopy too inaccurate to permit definite conclusions, the amount of pigment present in the trabeculum of nonglaucomatous eyes seems to depend upon the pigment content of the iris, and excessive pigmentation seems to occur only in glaucomatous eyes. Thus only excessive pigmentation has come to be recognized as being characteristic of some wide-angle glaucomas in which it has diagnostic significance. It must be remembered that the absence of excessive pigmentation by no means rules out wide-angle glaucoma. In many wide-angle glaucomas the appear-

\* This work was done by Drs. H. S. Koch and T. H. Luo in the Glaucoma Clinic of the Illinois Eye and Ear Infirmary.

ance of the trabeculum as well as that of the rest of the angle is in no way different from that of a nonglaucomatous eye, so that by gonioscopy the glaucomatous character of the eye in question cannot be recognized.

Excessive pigmentation of the trabeculum is usually associated with signs of pigment migration in the iris and all over the anterior chamber. Gonioscopy has failed to produce any new evidence in favor of the pigment-block theory or to shed light on the finer mechanism of this quasi-type of glaucoma. The fact is disturbing that in the many cases of capsular exfoliation without glaucoma excessive trabecular pigmentation is the rule.

How difficult it is to estimate the permeability of the trabeculum from its gonioscopic appearance is well illustrated by the many cases of chronic anterior uveitis in which pigmented and unpigmented débris is deposited on and within the trabeculum. There is no apparent parallelism between the intensity of these deposits and the incidence, course, and severity of the secondary glaucoma that develops in some of these cases. Again from the gonioscopic picture of trabecular changes alone one cannot tell to what extent the balance of the intraocular pressure has been or will be disturbed. In the rare type of recurrent mild cyclitis with elevation of tension at the first and each subsequent attack during which the gonioscopic picture remains perfectly normal, it appears certain that trabecular impermeability or angle obstruction of any kind plays no part at all. This is just another example of a mechanism producing a glaucomatous state which is associated with a normal gonioscopic appearance of the trabeculum.

There is a field where gonioscopy shines; that is, the examination of the sites of anti-glaucomatous operations. After trephining or iris-incarcerations in which the site of the operation is not completely concealed by adhesions between the

iris and the anterior wound lip, gonioscopic examination affords an excellent view of the area of operation and usually a simple explanation of its failure or success. The success of both, the trephining as well as the iridencleisis, depends upon the permanent patency of the operative wound or defect. In most permanently and unconditionally successful iridencleises, a portion of the incision is kept open by the interposition of iris in one or both corners of the wound, the iris acting not as a wick but to keep the wound lips separated. Thus, in slight deviation from Sugar's idea, we are inclined to think that a sclerectomy, if added to the iridencleisis, should be made in the portion of the incision that is not taken up by the incarcerated iris. This technique would seem to give the best chance for permanent gaping of the incision. Proliferation of retinal pigment, starting from the incarcerated-iris portion, is usually fairly pronounced, but rarely sufficient to cause late closure of the operative gap. Among the cases without visible gap of the surgical incision there were permanent successes, apparently through wick-action of the incarcerated iris. More commonly, however, the intraocular pressure did not remain within normal limits and miotics had to be used. In trephining, the conditions for permanent patency of the corneoscleral defect are ideal if uveal tissue or lens is entirely absent from its rim or lumen. The greater the portion of the circumference of the hole that is lined by uveal tissue the less chance there is of permanent patency. In order to avoid these adhesions, the site of the trephining should be well outside of the area covered by the PAS, and the postoperative contact between iris and cornea should be reduced to a minimum. A trephine opening may become closed by proliferative or scarifying processes in the subconjunctival space ("from the outside in"). While gonioscopy cannot be expected to give



information concerning these processes, it explains why the operation failed in most cases in which the dissection had been carried into the stroma of the cornea, beyond the rim of Bowman's membrane. There gonioscopy reveals that the outer covering of the trephine hole, although it is directly exposed to the intraocular fluid, does not become pliable enough to form part of a bleb or even to remain detached from the remainder of the cornea.

That a successful cyclodialysis is associated with the gonioscopic picture of a permanent supraciliary cleft leading into the suprachoroidal space is now generally known. That the cleft and not an "atrophy" of the dialyzed portion of the ciliary body is the actual pressure-reducing principle is clearly demonstrated by the recurrence of hypertension if the cleft closes up. The actual depth of these "pockets" is sometimes difficult to determine, nor are the factors well understood which favor or hinder the permanent patency of the pocket.

Sugar's statement<sup>10</sup> that "most failures of well-performed cyclodialysis operations are due to the persistence and organization of a blood clot in the aperture of the cyclodialysis cleft" is unquestionably correct. The presence of blood or fibrin in the pocket two weeks postoperatively is an unfavorable sign, although complete absorption of such clots without closure of the pocket has been observed. We have the feeling that in the operative failures bleeding into the pocket has continued for some time or recurred several times. Electro-coagulation of the anterior ciliary arteries in the region of the cyclodialysis immediately before the latter may be of value to reduce the danger of severe hemorrhages. From purely clinical analysis, cyclodialyses made in the upper half of the globe have a better chance of remaining open than do cyclodialyses made in the lower half. Late closure apparently occurs more often in eyes in which the

original pocket was narrow in meridional direction. Thus eyes with very shallow chambers appear to be less favorable subjects for cyclodialysis than eyes with deep anterior chambers. This point has been emphasized by Bangerter and Goldmann,<sup>1</sup> who apparently have used cyclodialyses more widely than ophthalmologists in any other large clinic. For the reason that the upper portion of the angle is usually the narrowest, Bangerter and Goldmann prefer to make the cyclodialyses temporally, in a location avoided by Sugar because of the danger of injury to the long posterior ciliary artery. Since this artery enters the ciliary body in the posterior portion of the orbiculus, a cyclodialysis can be performed temporally without injury to the artery. Bangerter and Goldmann contend that in the presence of a very narrow angle an iridectomy prior to the cyclodialysis improves the chances for a permanent patency of the latter. The available gonioscopic evidence is equivocal with regard to the effect of preëxistent PAS upon the permanent patency of a cyclodialysis pocket; although it would seem logical that, in an angle sector that is free of PAS, a cyclodialysis can be performed with greater ease and less trauma than in a sector closed off by PAS.

#### SUMMARY

The present status of gonioscopy may be summed up by listing some of its plus as well as its minus values.

*Plus values of gonioscopy:* 1. Gonioscopy offers a simple mechanical explanation for certain glaucomas. 2. Gonioscopy helps choose the type of operation most suitable for the case under consideration. 3. Gonioscopy helps recognize the causes of failure of glaucoma operations. 4. The information obtained by gonioscopy is of prognostic value in that it enables us to tell whether or not a filtering operation will continue to function. 5. The information obtained by gonioscopy may be of

value in inflammatory and traumatic diseases of the eye.

*Minus values of gonioscopy:* 1. Gonioscopy offers no explanation of the mechanism of certain glaucomas. 2. Gonioscopy requires some special equipment. From 2 to 4 hours are required to learn

the technique of gonioscopy. Considerable experience is required to interpret cases in which the landmarks have been obliterated. 3. Gonioscopy is conducive to the development of an over-mechanical concept of glaucoma.

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#### TORSION IN PERSONS WITH NO KNOWN EYE DEFECT\*

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From the numerous experiments that have been performed on the problem of torsion throughout the last 100 years, there has emerged no clear understanding or agreement among current authoritative sources. Physiologists hold that through the combined action of the external muscles of the eyeballs torsion does not occur; whereas ophthalmologists tend to regard it as abnormal. Starling,<sup>1</sup> Best and Taylor,<sup>2</sup> Howell,<sup>3</sup> and MacLeod,<sup>4</sup> either state specifically or imply that torsion does not occur. Ames and Gliddon<sup>5</sup> report from the Dartmouth Medical School measurement of cyclophoria (torsion) in clinical patients "suffering more or less acutely from their eyes." They speak of "cyclodeclination condition," "cyclotor-

sional trouble," "abnormal cyclotorsional condition," and "suffering from cyclo-diplopia" as if torsion were an abnormality of vision, yet they apparently have no facts as to what normal persons, or non-clinical subjects, might show in the way of torsion. They would probably admit as does Duke-Elder<sup>6</sup> that a "certain amount" of torsion might be normal. For the purpose of establishing this "certain amount" the experiment herein to be reported was performed. Carow<sup>7</sup> is the only individual found working on the problem who seemed to realize the importance of measuring torsion in large numbers of pathologic cases. He measured torsion in 107 employees of a Berlin police station. Most of his subjects had eye defects of one kind or another, but at least they were not recruited from clinics; only 14 subjects yielded what he regarded as good data. His analysis of the data consisted only of the calculation of averages.

\* From the Department of Psychology. University of Washington. A résumé prepared by the author of his much more detailed paper, which appeared in the Jour. Exp. Psychol., 1943, v. 32, April, no. 4, pp. 307-324.

From the foregoing considerations it seemed advisable to measure torsion in persons with no known eye defect in an attempt to answer the following questions: 1. Is torsion a normal or an abnormal phenomenon? 2. If it occurs in normal vision, what direction of torsion may be expected? 3. What is the average amount that might be expected? 4. What is the normal variability that might be expected from one person to the next? 5. Does it vary with variation in elevation of vision above and below horizontal? 6. Does it vary with changes in convergence? 7. Are the torsional movements bilaterally symmetrical for the two eyes? 8. What are the torsional changes with oblique and lateral fixation points in the visual field? 9. Is it a source of distress in vision? The following report of experimental procedure and the results obtained is an attempt to answer all but the last three of these questions.

Three essentially different methods of testing torsion have been used. Some of the conflicting statements about torsion arise as an artefact of the method used. One method frequently cited uses the afterimage. However, only the monocular afterimage may yield valid results. The binocular afterimage would not show validly the torsion in either one or both eyes, owing to the fact that a binocularly fixated point or figure, seen as single during fixation, never produces a double afterimage; the perceived position of the afterimage tends to remain a function of the positional relationships maintained during retinal fatigue. Statements by Starling,<sup>1</sup> Duke-Elder,<sup>6</sup> and Tscherning<sup>8</sup> are invalidated by the fact that they are based upon the use of the binocular afterimage.

A second method is that of observing directly torsion by use of a telescope with vernier scale, the cross-hairs of which can be superimposed on distinctive markings of the iris. This method is recommended

for its objectivity. However, with the telescope used by Loring<sup>9</sup> in the local laboratory I found it difficult to discriminate with any degree of certainty changes of less than a degree. Moreover, Loring reports that pupillary changes even with constant illumination made it difficult at times to identify the distinctive marking previously sighted.

A third method of measuring torsion is

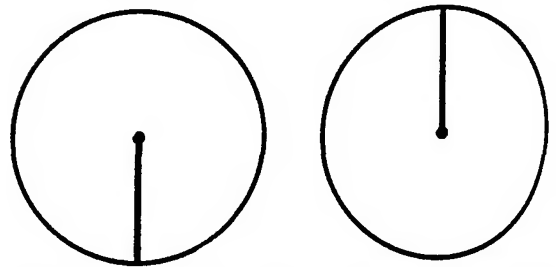


Fig. 1 (Hermans). Figures of the "Volkman disc" type for binocular fusion.

that of presenting to the two eyes separate figures that are binocularly fused by means of some stereoscopic device when their angular rotations on the visual axes are in proper relationship. The type of figures or targets commonly used is what has come to be known as "Volkman's discs." These are circles set at right angles to the visual axes with the centers as points of fixation; a radius is drawn on each circle, but on opposite sides of the centers, so that when one or both discs are properly rotated the radii become an apparent diameter of the circle (fig. 1). If diameters are drawn on the two circles the subject then has to discriminate when the lines are perfectly superimposed; they must fixate some point on the line and tell when there is no apparent doubling of the lines peripheral to the point of fixation. Such discrimination of double images is difficult for the naïve subject and may give unreliable results. The use of targets by Ames and Gliddon,<sup>5</sup> requiring peripheral discrimination of double images, plausibly accounts for their incredible report that "Usually the declination of

TABLE 1

GIVING: (1) NUMBER OF SUBJECTS, (2) OBTAINED AVERAGE VALUE OF TORSION, (3) STANDARD DEVIATION, (4) THEORETICAL AVERAGE, FROM 40° ABOVE TO 40° BELOW HORIZONTAL AND FROM 0 TO 10 DEGREES OF CONVERGENCE

	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°
+40°	77	95	95	87	72	55	40	30	23	14	10
	.16	.43	.55	.71	.81	1.02	1.19	1.51	1.74	2.24	1.95
	.74	.78	.79	.85	.75	.86	.79	1.02	1.13	1.77	1.09
	.20	.33	.48	.64	.81	.99	1.18	1.38	1.60	1.83	2.06
+30°	84	103	101	95	87	67	49	37	31	25	15
	.05	.19	.30	.39	.54	.74	.78	1.14	1.54	1.82	2.00
	.57	.55	.65	.57	.66	.66	.79	.81	.98	1.04	.80
	.16	.28	.41	.56	.71	.88	1.06	1.25	1.45	1.66	1.88
+20°	85	102	103	97	93	78	52	37	31	27	22
	.04	.18	.30	.41	.51	.70	.88	.96	1.25	1.50	1.63
	.41	.40	.49	.49	.52	.56	.70	.66	.72	.64	.72
	.13	.23	.35	.48	.62	.77	.93	1.11	1.29	1.49	1.70
+10°	87	103	104	100	89	72	50	40	32	27	21
	.10	.16	.26	.38	.46	.60	.79	.92	1.09	1.31	1.63
	.41	.43	.42	.49	.52	.54	.51	.51	.55	.65	.58
	.10	.19	.29	.41	.53	.67	.81	.97	1.15	1.33	1.52
0	90	103	104	101	89	71	51	42	33	28	15
	.07	.17	.23	.35	.43	.49	.72	.91	1.08	1.08	1.28
	.30	.36	.38	.48	.52	.56	.59	.57	.46	.62	.71
	.07	.14	.23	.33	.44	.56	.70	.84	1.00	1.17	1.34
-10°	84	102	104	100	94	79	58	46	38	30	19
	.13	.19	.29	.41	.51	.62	.65	.85	1.04	1.18	1.23
	.43	.43	.46	.53	.58	.61	.61	.61	.66	.70	.66
	.04	.10	.18	.26	.36	.46	.58	.71	.85	1.01	1.17
-20°	81	102	104	101	94	80	59	43	37	27	15
	.10	.14	.22	.30	.44	.44	.57	.70	.85	.88	.83
	.44	.44	.46	.56	.57	.55	.64	.50	.52	.59	.54
	.02	.06	.12	.19	.27	.36	.47	.58	.71	.85	1.00
-30°	79	102	102	99	91	78	59	43	26	19	14
	.03	.06	.15	.23	.29	.37	.34	.41	.59	.42	.54
	.47	.45	.43	.54	.56	.57	.79	.87	.81	.58	.44
	-.01	.03	.07	.12	.19	.27	.36	.46	.57	.69	.83
-40°	69	99	104	101	92	82	64	42	32	20	11
	-.07	.01	.09	.15	.21	.26	.17	-.04	.16	.12	.13
	.51	.55	.51	.58	.66	.79	.79	.95	.69	.77	.59
	-.03	-.01	.02	.06	.11	.17	.25	.33	.43	.54	.66

the vertical meridians is greater than that of the horizontal."

From a careful consideration of the various methods of measuring torsion, it seemed advisable for the present study to use the stereoscopic technique with targets of the Volkman disc type. They were circles 1 inch in diameter; projecting 4½ inches beyond the circles were bars one-eighth inch wide; with one circle the bar projected downward and with the other

upward. In effect, these targets combined binocularly as radii of a circle 10 inches in diameter. With a system of mirrors known as a telestereoscope changes in convergence could be effected. Changes in elevation of vision were made possible by rotation of the apparatus vertically about an axis approximating the center of rotation of the subject's eyeballs. The subjects rotated the targets synchronously in opposite directions until the bars appeared to

make one continuous straight line through the stereoscopically fused circle. Their adjustment of the targets could be read to one tenth of a degree.

The subjects used in the experiment were 104 naval R.O.T.C. students who had had recent eye examinations and had

Readings were taken only to 10 degrees of convergence; incidentally, this refers to the angular change in each eye.

A distribution of the subjects' judgments for each of the 99 combinations of convergence and elevation was made, and the average and standard deviation from

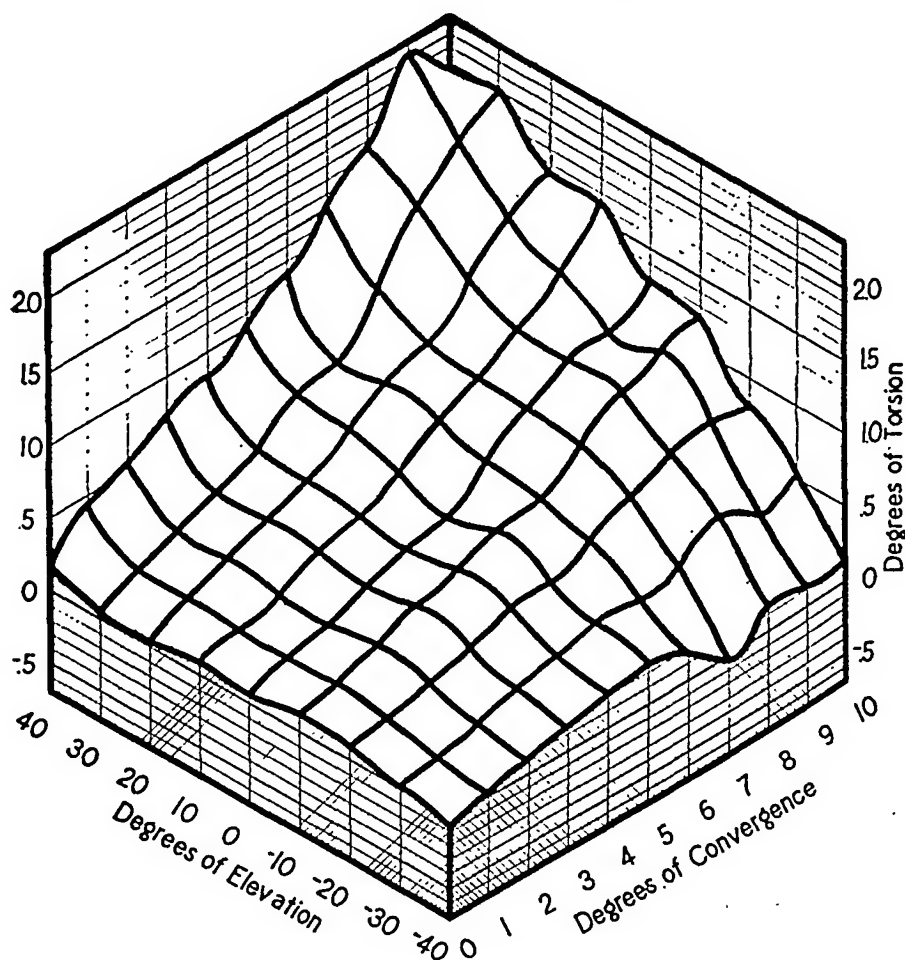


Fig. 2 (Hermans). Obtained average values of torsion plotted against the two variables, convergence and elevation of vision.

been passed as "normal"; that is, with 20/20 vision and no detected visual defect. Readings of the subject's adjustment of the targets were taken at as many combinations of elevation and convergence as the subject was able to maintain binocular fusion of the targets. A few subjects found it impossible to fuse the targets with parallel axes of vision, and every one would reach some point of convergence beyond which fusion was impossible.

the average calculated for each distribution. The values derived from these calculations are given in the accompanying table; the horizontal variable represents degrees of convergence, the vertical variable, the degrees of elevation of vision above and below horizontal. The first item in each cell of the table indicates the number of subjects able to make judgments at this combination of the two variables. The second item is the average

value of the subjects' adjustment of the targets. The direction of rotation of the targets is a tipping of the vertical diameters of the fused circles of the targets away from each other at their tops. Correspondingly, the rotary direction of the eyes is that which would result from unopposed contraction of the inferior

disinclination of the upper ends of the vertical meridians of the eyes from the medial plane. The two exceptions are indicated by the minus sign. The third item in each cell is the standard deviation from the average of the obtained values. This is a measure of the variability of subjects and defines the limits on either side of

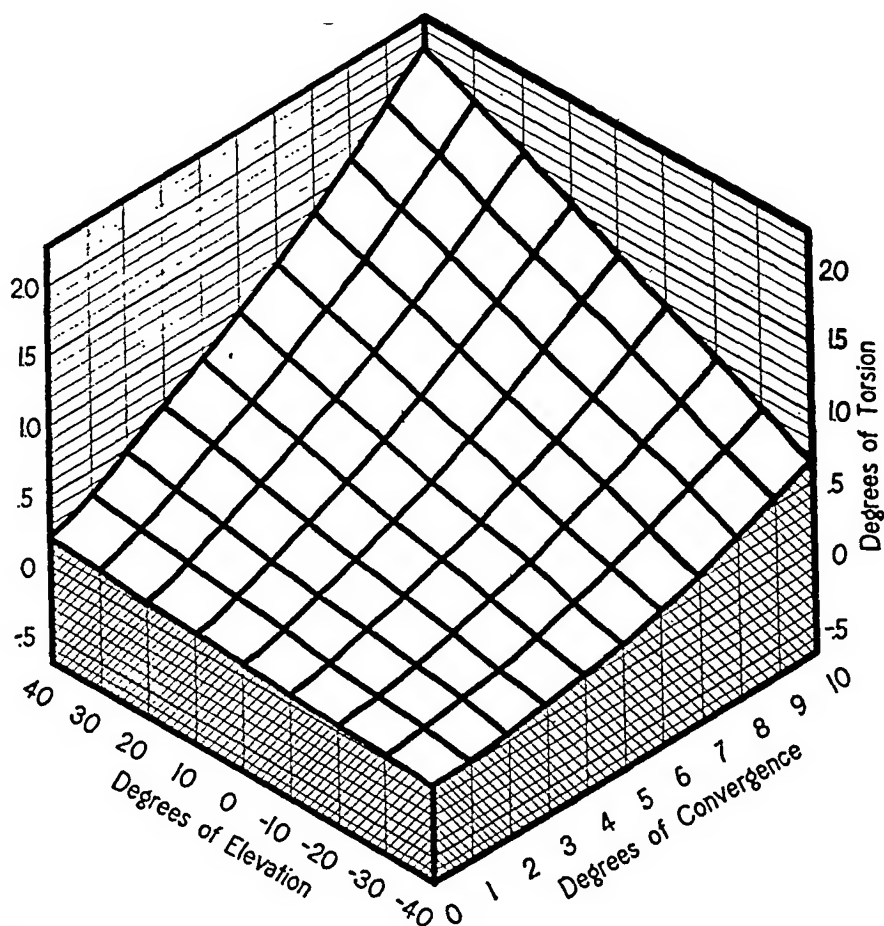


Fig. 3 (Hermans). Theoretical values of torsion plotted against the two variables, convergence and elevation of vision.

oblique muscles. For simplicity in speaking of torsion we shall assume that these figures refer to torsion of the eyes; for obviously, the eyes have undergone torsion of these amounts and the targets have had to be rotated in the same amount and direction to meet the subject's requirements for judgments of straight lines. The direction of the torsion indicated (with two exceptions) is an ex-torsion or

the average within which the middle 68 percent of the torsion values were found. To illustrate, 104 subjects made judgments with vision horizontal and with 2 degrees of convergence; the average judgment was .23 degrees, and standard deviation .38 degrees; 68 percent of their judgments were between .23 - .38 and .23 + .38 or between -.15 and +.61 degrees; the remaining 32 percent of sub-

jects made judgments that deviated more than .38 degrees from the average. The fourth item in each cell is the theoretical average; how this was obtained will be explained later.

Figure 2 shows the three-dimensional surface obtained when the average values of torsion in degrees are plotted against degrees of elevation and degrees of convergence. The striking appearance of regularity of this surface suggests the desirability of obtaining an equation descriptive of the relationship between the three variables. Theoretically, the surface would be entirely smooth if a large enough number of subjects had been used. On this assumption calculations were made and the following equation derived:

$$Z = +.00573x^2 + .00001y^2 + .00148xy + .07029x + .0028y + .06876$$

Z represents degrees of torsion, x degrees of convergence, and y elevation of vision in degrees above (plus) or below (minus) horizontal.

Using this equation, theoretical values of torsion were calculated for the 99 points of the graph. The fourth item in each cell of the table is this theoretical

value. Figure 3 shows this smoothed surface. To illustrate how closely the two surfaces coincide it should be pointed out that the standard deviation of the differences between the obtained and theoretical averages is .13 degrees; that is, 68 percent of the theoretical values of torsion are within .13 degrees of the obtained values.

In conclusion, torsion has been shown to be a normal phenomenon of vision. The direction of torsion to be expected is a disclination at the top of the vertical meridians of the eyes relative to the medial plane, except at extreme positions of elevation below horizontal and with a small amount of convergence; in this position the torsion is reversed. The average amount of torsion to be expected for any combination of convergence and elevation is expressed by the above equation; this may be regarded as a law descriptive of eye-movement. The amount of variability in torsion that one might expect in individual cases, and still be regarded as normal, is expressed best by the various standard deviations from the average values as indicated in the table.

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HIGH CONGENITAL MYOPIA WITH CONVERGENT STRABISMUS\*

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In 1930, a child, 22 months of age, was referred to me for examination because the eyes had a definite tendency to cross when looking at close objects. The refraction, measured with the eyes under the effect of atropine, showed 16D. of myopia in each eye and, much to my surprise, the convergent squint completely and immediately disappeared as soon as the child was provided with glasses. This unusual experience prompted a reasonably thorough review of the literature on similar cases. All that one could find was a case report here and there of an infant with a high degree of myopia, but no mention of any strabismus and, most important of all, no observations over a period of years to give one any idea of what to expect in regard to the visual prognosis for children having this defect.

Many questions presented themselves. What was the cause of the strabismus, and why was it corrected by concave lenses? Was this myopia really congenital, owing to the lens being more spherical than usual, or was it axial? Do such cases progress and ultimately result in the extremely high myopia with marked retinal destruction that we see at times? This study is an attempt to answer these questions.

In the past 13 years, 25 children have been examined who had what can reasonably be called high congenital myopia. An arbitrary standard of five diopters of myopia before school age has been adhered to with a few exceptions. Myopia associated with obvious microphthalmos or ectopia lentis has not been included nor have cases of monocular myopia. Refractions have been repeated as often as

indicated. In five of the patients the refraction was measured only once, so these are not included in the figures showing changes in the amount of myopia.

The following table shows most of the facts revealed by this study:

TABLE 1

HIGH CONGENITAL MYOPIA WITH CONVERGENT STRABISMUS—SHOWING AMOUNT OF MYOPIA, RATE OF PROGRESS, AND FREQUENCY OF STRABISMUS

Number of patients with high congenital myopia.....	25
Number of patients refracted more than once.....	20
Average age at first examination..	4.3 years
Average amount of myopia at first examination.....	-10.45D.
(Max. -16.50; Min. -4.50)	
Average age at last examination..	8.8 years
Average amount of myopia at last examination.....	10.88D
Average period of observation...	4.1 years
Average change in refraction per year.....	-.18D
Number of eyes becoming more myopic (total 40).....	19
Number of eyes becoming less myopic (total 40).....	15
Number of eyes showing no change of refraction (total 40). ....	6
Number of patients with convergent strabismus.....	15
(All recovered except two, in one the squint became divergent later)	
Number of patients with divergent strabismus.....	1

The high incidence of convergent strabismus is remarkable. In one case the deviation was 35 degrees, in all of the others the deviation was only 10 to 20 degrees, and in many cases it was not constant. The fact that it was of low degree and usually was corrected immediately by the use of glasses suggests the possibility that it was a physiologic condition related to the fact that the far point was so close to the child's eyes. It might be assumed that, inasmuch as everything more than 10 cm. away is indis-

\* Read before the Chicago Ophthalmological Society, March 15, 1943.

tinct in a case of myopia of 10D., the child makes his binocular adjustment for close objects only. Some of the facts are not in accord with this simple explanation, however. There were a few cases in which amblyopia of moderate degree could be demonstrated when the child became old enough to have suitable tests made, and in several cases fusion and stereopsis were subnormal. One child had a convergent strabismus of 20 degrees and myopia of 12D. at three years of age; the strabismus was corrected immediately by the glasses, but at the age of 11 years she developed divergence excess with 18 degrees of exotropia for distance. She had vision with glasses: R. 20/25, L. 20/15 and had good fusion and stereopsis.

It is quite obvious that this type of myopia is different in many ways from the usual axial type that begins in the early school years, increases during the years of growth, and then becomes more or less stabilized. The very slow average rate of increase ( $-0.18D.$  per year) in this series is very gratifying. These children have all been able to make satisfactory progress in school, most of them in regular school, a few in sight-saving classes, and it does not appear that the work has harmed their eyes. A myopic conus was observed in only two patients, one with 10D. of myopia and one with 15D. Other patients with just as much myopia did not have a conus nor any myopic retinal changes. In no case did the eyes appear abnormally larger or protruding; in fact, the opposite was usually the case. We are all familiar with myopia in cases of microphthalmos and ectopia lentis where the anteroposterior diameter of the globe is not abnormally great. The lack of stretching of the posterior seg-

ment of the eye and the very slow rate of increase in myopia in these congenital cases strongly suggest the possibility that the cause of the myopia is due to the lens being abnormally spherical. This assumption is in agreement with what is well known regarding the development of the infant eye. Measurements have shown that the lens of a normal eye of an infant has twice as great a curvature as in the adult. The reason this condition of the lens does not always result in the infantile eye's being myopic is that it is usually more than compensated for by the short anteroposterior diameter of the eyeball at birth. Congenital myopia will be present if the anteroposterior diameter is not short enough to compensate for the myopia owing to excessive curvature of the lens. Such myopia may decrease as the lens becomes less spherical with age unless this is offset by an increase in the anteroposterior diameter, or it may increase if the anteroposterior diameter becomes greater at a more rapid rate than is compensated for by the change in the lens. In this series the two processes apparently took place at about the same rate, so there was no marked change in the refraction.

#### CONCLUSIONS

1. High congenital myopia and convergent strabismus are often associated.
2. The myopia is lenticular in origin and relatively nonprogressive, at least up to the age of adolescence.
3. The convergent strabismus is of low degree, is usually corrected by glasses, and is, on the whole, relatively unimportant.

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#### DISCUSSION

DR. WILLIAM F. MONCREIFF: Dr. Gamble's paper presents two separate and

distinct problems: first, that of congenital myopia as an etiologic factor in con-

vergent squint; second, that of the pathogenesis of congenital myopia. These two problems would appear not to be closely related, their juxtaposition in the paper being accounted for by the circumstance that in some 60 percent of the cases of congenital myopia reported, a convergent position of the eyes was observed, tabulated as convergent strabismus.

As to the role of congenital myopia as a causative factor in convergent strabismus, Dr. Gamble's remark that a child with congenital myopia of 10D. makes his binocular adjustment for close objects only, is in accord with the observations of Chavasse, who pointed out that the extreme nearness of the far point, varying from less than 6 cm. to an average of not more than 10 cm. requires such a high angle of convergence for the development of binocular single vision, that with its development must come more or less strong esophoria; this, if prolonged for a sufficient time, may be finally transformed into esotropia.

One may question whether the convergent position of the eyes observed in 15 of these congenitally myopic patients was in every instance a true esotropia. Convergence of the visual axes on near objects, to the meter angle equivalent of the distance, is a physiologic fact and necessary for binocular single vision; also, the term esotropia, or convergent strabismus, does not apply unless the convergence exists when fixating an object at a distance of 6 meters or more. How can one correlate or compare the observed angle of convergence with that appropriate to the distance of fixation when there is no accurate means of determining what the fixation distance is? Furthermore, how can an infant or child with 5 to 18D. of myopia, uncorrected by lenses, fixate an object at a distance of 6 meters which he cannot even see? The fact that convergence disappeared promptly in many

cases with the application of correcting lenses adds further to the suspicion that the convergence was not that of a true esotropia.

In the nine patients in whom no convergence was observed there was an average of 10D. of myopia or more; in one case the myopia was as high as that of any other patient in the entire series. In the majority of these cases the difference in refraction between the two eyes was at one time or another only one diopter or less, and, in most of the cases, correcting lenses were first applied in the fourth year or younger. Could it be that within the limits of the far point, those with about equal myopia in the two eyes developed sufficiently good stereopsis to prevent the occurrence of esotropia? Some of the others perhaps did not begin to exercise their visual faculties to any marked extent on near objects and small details prior to the first correction of the refraction.

The essayist noted the presence of amblyopia and defects of stereopsis in certain cases in which a true strabismus persisted beyond the age of six years. Further analysis of details not reported in the paper might show the cause to be high astigmatism in one eye only, or much higher myopia in one eye than in its fellow.

As to the pathogenesis of congenital myopia, the essayist states that this is lenticular in origin. No proof of this conclusion is offered, but the idea is apparently adopted as an alternative to the more tenable one of an axial myopia. He rejects axial myopia as an explanation because (1) choroidal, retinal, and other fundus changes observed in high myopia in many adults were not present; (2) there was no significant increase in the amount of myopia in any case, and even a decrease in some cases. The first consideration is untenable; it is well known

that, with the exception of a simple conus (malformation) due to obliquity of the optic-nerve-entrance canal, these other fundus changes require some years for development, and, as a rule, are not to be seen in infants or even older children until beyond the age of puberty. The second consideration has no significance, owing to the complexity of changes occurring in the early years of growth and affecting all the factors which determine the refraction of the eye.

The three most essential factors that determine the static refraction of any nonaphakic eye are the cornea, the lens, and the axial length of the eyeball. The most variable of these in the newborn and in the developing infant, as regards their effect on total refraction, are, in all probability, the cornea and the length of the eyeball. Variations between different individuals in the size, curvature, index of refraction, and in general the refractive power of the lens of the infant or newborn are probably too small to account for anything more than a diopter or two of variation from the norm in refraction.

In the present state of our knowledge, according to such authorities as Vogt, Scheerer, von Szily, Seefelder, Wessely, and Schnabel, it may be said that congenital myopia is due to anomalous development of the eye in the anterior segment or the posterior segment or both. There may be a so-called refractive myopia, due not to a higher-than-usual refractivity of the lens, but to increased refractive power of the cornea, which has a shortened radius of curvature. This is sometimes combined with a greater-than-average diameter of the base of the cornea. An axial diameter of the eyeball of the newborn sufficiently in excess of the

normal 17.5 mm. to produce 5 to 15D. or more of congenital myopia, is a mild grade of malformation due to limited overgrowth of the neural ectoderm of the secondary optic vesicle, which, in many cases, may be confined to the posterior half of the eyeball, but in others may predominate as an overgrowth of the ciliary zone, from limbus to ora serrata.

DR. ROBERT VON DER HEYDT: This paper gives good reasons for the convergence, its immediate correction by the strong minus glasses, and the high myopia as being due to the lens, which is quite spherical in some very young children. Children born with high lenticular myopia need not necessarily later develop progressive myopia; this is a quite separate hereditary fate.

Dr. Moncreiff apparently agreed with Dr. Gamble except for differentiating between myopia of corneal origin and that of lens origin. Both essayist and discussor should be congratulated on presenting the problem so lucidly.

DR. RICHARD C. GAMBLE (closing): In regard to the first point brought up, Dr. Moncreiff seems to be even more inclined to the idea of physiologic convergence than I am. As to the second point, Dr. Moncreiff has studied sections of infants' eyes and is well aware of the fact that the lens in an infant's eye is more spherical than it is in the adult. It is hard to understand why he does not consider this fact important.

Dr. Von der Heydt in his long experience has apparently observed some of the things described in this paper, and it is gratifying to hear him say so. He himself has had to find them out by watching the patients as they grew up.

ROBERT VON DER HEYDT.

## COATS'S DISEASE

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Through the courtesy of Dr. David H. Webster, I am able to present the pathologic findings in a case of Coats's disease. The history of the case as given by Dr. Webster follows:

"I first saw R. P. on September 9, 1941. The mother stated that the right eye was

muscle exercises. The patient is now 10 years of age. When I saw her she had a head tilt, ptosis of the right lid, and extreme photophobia; the eyeball appeared shrunken; vision was 1/200 in the lower field. The slitlamp showed new blood vessels in the iris; the latter was pushed

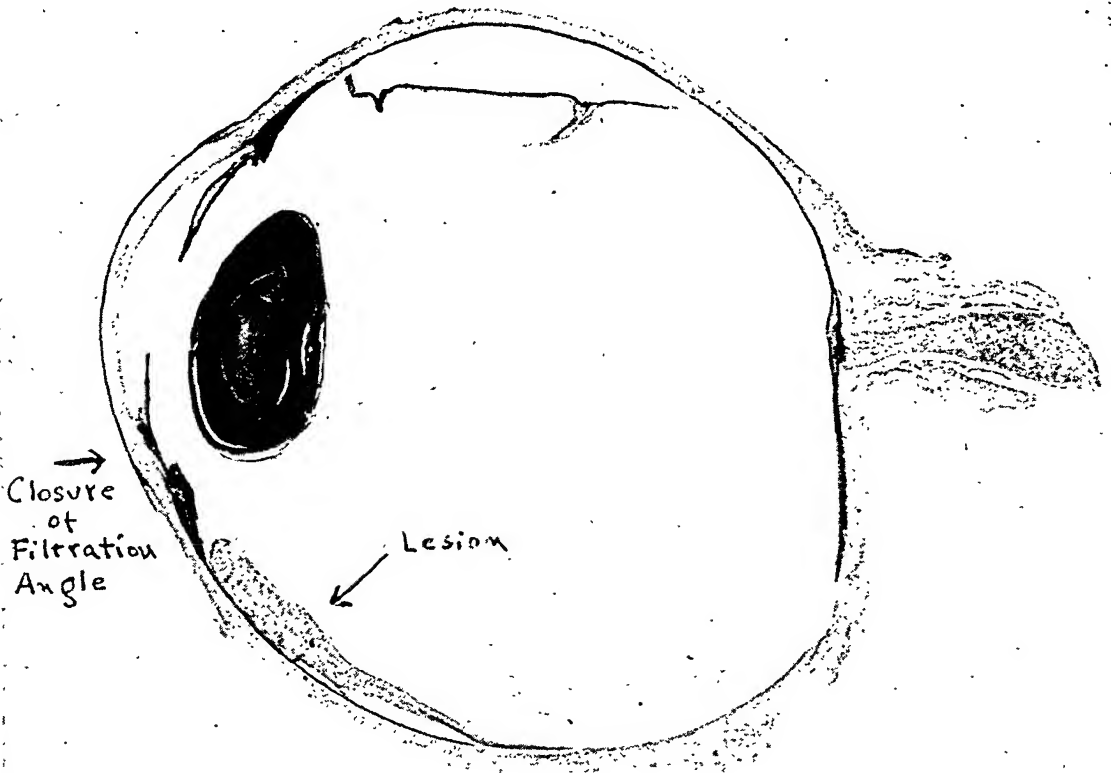


Fig. 1 (Laval). The involved area occupies all the layers of the retina. Note the adhesion of the iris to the posterior layers of the cornea with resultant closure of the filtration angle. The ciliary body is not involved.

closed at birth, and that at three months of age a convergent squint was first noticed. When the child was  $7\frac{1}{2}$  years old the muscles of the right eye were operated upon for the correction of this deformity, and at the age of  $8\frac{1}{2}$  years a further attempt was made to correct it. Following that she tried occlusion and

forward against the cornea in the region of the 7-o'clock position. The ophthalmoscope showed massive exudative retinitis with plaques of pigment; transillumination was difficult. A diagnosis of Coats's disease was made. The eye was removed on September 29th on account of extreme photophobia and constant headaches."

The gross and microscopic findings are as follows:

The eyeball is normal in size and shape. In the lower portion of the retina anteriorly is a small raised mass extending toward the vitreous and reaching from the ciliary body toward the equator (fig. 1). The ciliary body is not involved. Most

and free pigment lying in the filtration angle. The mass in the retina is cellular and contains cells having deeply staining nuclei which are round cells, but most of the cells are fibroblasts with spindle-shaped nuclei. There is much connective tissue (fig. 2). Occasional vessels are present in the mass and round cells en-



Fig. 2 (Laval). Marked connective-tissue proliferation. The arrow points to albuminous fluid between the choroid and the mass. Two drusen of the lamina vitrea can be seen below the arrow. To the left of the center is seen a dense mass of pigment. (Low power.)

of the mass is in close apposition to the choroid, but a small part of it posteriorly is lifted away from the choroid by albuminous fluid. The filtration angle is occluded by the iris, which is adherent to the cornea below. Microscopically it is seen that there is marked proliferation of pigment on the anterior surface of the iris with a moderate increase in round cells

velop these vessels. Clumps of pigment are present and proliferation of the pigment epithelium is moderate. In the inner layers the blood vessels of the retina are preserved, but the walls are thickened. The inner limiting membrane of the retina is intact. In the outer layers, the rods and cones are completely destroyed, and here some goblet cells are seen, which may

be swollen cells of the destroyed rods and cones (fig. 3). The other nuclear layers of the retina are gone, and in their place are connective tissue, round cells, and fibroblasts with clumps of pigment. The choroid is partly involved but in other places is intact, with fluid between it and the retina. Here the lamina vitrea is swol-

majority of the patients presented by other writers were between 2 and 19 years of age; the majority were also males. The condition is found rarely in patients over 25 years of age, and was once reported in a child of 10 months.<sup>2</sup>

According to Coats's original concept the lesion is primarily vascular and

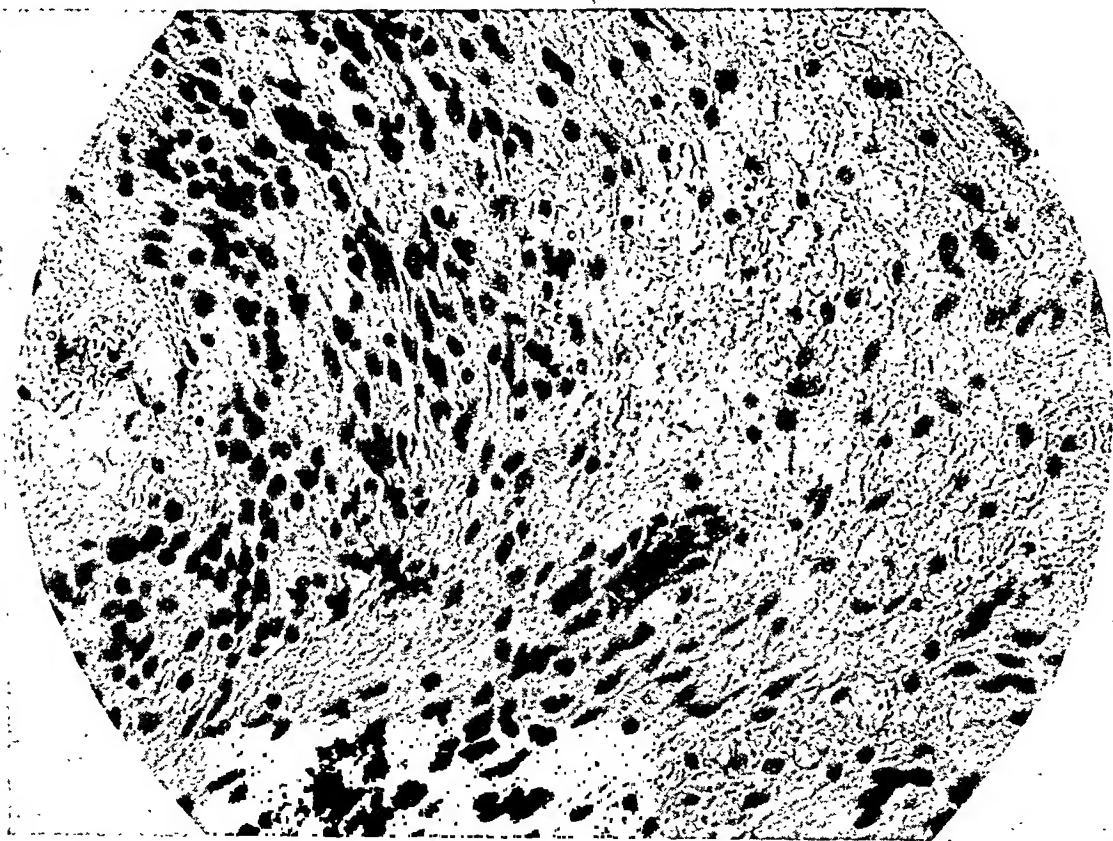


Fig. 3 (Laval). High power, showing goblet cells or "ghost cells."

len into drusen with pigment epithelium overlying them. Prepared with the Wilder stain it is seen that the mass is predominantly connective tissue with moderate vascularization.

#### COMMENT

Coats's<sup>1</sup> original presentation consisted of 11 cases, 4 of which were in females and 7 in males. Of these 11, 5 were in patients between the ages of 6 and 8 years; 1 patient was 12 years old, and 5 were between 26 and 37 years old. The

hemorrhagic. The proliferation of neuroglia that takes place and that is so profuse at times as to give the appearance of a veritable tumor is only secondary. Retinal detachment, proliferation of pigment epithelium, and new-formed connective tissue follow later. Leber,<sup>3</sup> however, considers the lesion as essentially inflammatory and necrotic; following the inflammation, there ensues necrosis of the retinal tissues, desquamation of the pigment epithelium, and formation of hemorrhages and exudates. The picture is vari-



able, so that in some cases vascular and hemorrhagic features are pronounced whereas in others these factors are minimal, and inflammatory exudation and organization are more prominent. The choroid is usually not involved but may at times be involved secondarily. The retina in the affected area is extremely degenerated and almost completely replaced by fibrous tissue; the vessels are sclerosed, and glial tissue proliferates to varying degrees with destruction of the neural elements.

Some observers believe that the origin of the vascular lesions is infectious owing to small infected emboli; others believe the origin to be tuberculous. In some cases the angiomatous formations are so large that some consider the original lesion to be the aneurysmal dilatation with angiomatous formations which finally cause exudative changes in the retina with detachment. (This latter, however, is really Hippell<sup>4</sup>-Lindau's disease and does not belong to the group designated Coats's disease.)

Coste<sup>5</sup> in 1938 reviewed the entire literature and found that 29 cases had been reported in males and 22 in females, making a total of 51 up to that time; he included 2 cases of his own. His bibliography is quite complete. Lamb<sup>6</sup> in 1938 also reviewed the literature and added eight cases. He concluded that the "essential change is an infiltration of the retina in whole or in part with albuminous and edematous fluids, leading to an exudate of the same fluids under the retina and a resulting complete or partial detachment of the retina. The . . . late cases are further distinguished by the presence of large amounts of connective tissue between the choroid and the retina or in the retina." He further states that the exudative process is diffuse throughout the retina and not only in the external layers as Coats found it. He agrees, however, that an inflammatory process is pres-

ent and for that reason agrees with Coats's later concept of "exudative retinitis." Lamb makes the point that the pigmented epithelial cells of the retina become macrophages and then are transformed into fibroblasts. These then proliferate and lay down the dense masses of connective tissue found in cases of Coats's disease. Clinically, there are large yellowish-white masses of exudate in the fundus, lying under the retinal vessels which may be obscured in places, however. Most commonly these masses are at the posterior pole but not uncommonly they are in the periphery. Hemorrhages are frequently present and often cholesterol-like glistening deposits are seen. The vessels may be tortuous or looped, or even occasional anastomoses may be present. Detached retina, glaucoma, iridocyclitis may ensue; in other cases the process goes just so far and then remains stationary, while in some a pseudogliomatous mass may be formed.

An interesting paper by Holm,<sup>7</sup> published in Copenhagen, in 1941, makes the point that there is a great similarity between Coats's disease and retinitis circinata and also macular proliferation both of the senile and juvenile types. In studying the pathology of these various conditions one is struck by the great similarity and also by the overlapping of the fundus pictures as seen clinically. In Duke-Elder's text book are compiled all the views and reports of different observers of the accepted pathologic pictures of these allied conditions.

*Summarizing* then, it may be stated that Coats's disease and circinate retinopathy depend primarily on changes in the retinal arterial system, whereas senile and juvenile macular degeneration are the result of changes in the choriocapillaris.

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## POSTOPERATIVE ENDOGENOUS INFECTION OF THE EYE WITH RECOVERY

### REPORT OF TWO CASES

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Postoperative infections of the eye may be ectogenous or endogenous. In the first instance, infection shows itself 24 to 48 hours following an operation, usually cataract extraction.

The first sign is a grayish edema of the cornea around the incision and edema of the nearby conjunctiva. The infection has a tendency to spread rapidly and soon a hypopyon makes its appearance. Shortly the entire cornea becomes hazy, the conjunctiva greatly chemotic, and, before long, the vitreous is invaded. Usually there is an outpouring of purulent material through the wound of the cornea. In the majority of cases the eye requires enucleation or it eventually shrinks to an extreme degree.

According to Fuchs,<sup>1</sup> endogenous infections are usually the result of septic emboli thrown off by septic foci, invading a local point made less resistant as a result of trauma (operation), in the same way that an osteomyelitis may involve bone at the point of local injury. The condition, while it occurs occasionally

in an eye which has been operated upon under the best possible circumstances (asepsis, operative technique, and the like), is thought to occur more frequently if there has been excessive ocular manipulation.

This type of infection usually shows itself on the fifth or sixth day following an operation, though a much earlier appearance has been reported.<sup>2</sup> The initial reaction is not apt to be so virulent. There is some clouding of the cornea, moderate circumciliary reaction, and a small amount of hypopyon. As the infection progresses, the hypopyon increases and the reaction of the eye becomes more severe. Soon the eye takes on the same serious appearance that follows exogenous infection and with the same results.

Occasionally the infection is not so fulminating and it may subside, leaving a dense plastic exudate in the anterior chamber and usually in the vitreous chamber as well. These exudates shrink and result in phthisis bulbi. Rarely, however, the eye itself may be spared serious

damage and only a dense membrane in the anterior chamber be the final result. When this is cut the eye may regain useful vision.

Fortunately, postoperative endogenous infection is not common—in spite of the impossibility of eradicating all foci of infection, often because the eye itself has become the focal point of infection.<sup>2</sup> For this reason two cases in which good results were obtained in spite of severe postoperative infections are deemed worthy of report.

*Case 1.* T. S., a man, aged 81 years, came to the office (of D. K.) on January 4, 1943, because of progressive loss of vision for the past year. At present vision was so poor that he had to be led around. He had had diabetes for many years. About seven weeks prior to this visit he had developed an acidosis and was taken to a hospital where he remained for six weeks. During his stay at the hospital he lost 40 lbs. in weight and his diabetic condition was brought under control.

Examination revealed an almost mature cataract in the right eye and a mature cataract in the left eye.

The patient was admitted to the Brooklyn Eye and Ear Hospital for extraction of the lens of the left eye on January 5, 1943. A preoperative smear was negative for pathogenic organisms. On the same day, an attempt at an intracapsular extraction was made, but the lens could not be dislocated. The capsule was then incised with the cystitome and the lens expressed. Additional cortex was removed by irrigation. The wound was closed with two corneoscleral sutures, at the 2- and 10-o'clock positions. At the first dressing, two days later, the eye was white. On January 8, 1943, the eye was white and there was a small amount of cortex present. That night the patient was found under the bed, but the dressings were in

place. On January 9th, a small amount of conjunctival secretion was observed. The eye was uncovered and sodium sulfathiazole solution, 5 percent every two hours, was instilled. The patient also was allowed out of bed.

On January 10th, the conjunctival secretion had disappeared, but the cornea around the lips of the wound was somewhat hazy and there was a slight amount of hypopyon in the lower anterior chamber. The eye was moderately injected. Sulfadiazine, gr. 15 every four hours for six doses, was ordered to be followed every four hours by gr. 7ss. of the drug. Two tablets of abdol, vitamin tablets, three times daily were also prescribed. On January 11th, the hypopyon did not seem greater and the eye appeared about the same. The next day, the hypopyon had increased to fill about half of the anterior chamber, and the eye felt soft to digital pressure. By the 14th, the anterior chamber was about three-fourths full with hypopyon and in addition there was an exudate in the upper part of the anterior chamber near the corneal section. Following this day the hypopyon seemed to decrease steadily. The patient refused to stay in the Hospital and was discharged on the 19th of January with a note that there was still an abundant amount of exudate in the anterior chamber but that it seemed to be receding. There was only a moderate amount of reaction in the eye.

During his stay at the Hospital the patient received a diet consisting of carbohydrates 150, proteins 60, and fats 110 gm. He also received 20 units of protamine zinc insulin before breakfast.

The patient was kept on sulfadiazine for a week after leaving the Hospital. The hypopyon kept receding, and a tendency to membrane formation was noted, so that by April, 1943, the eye was entirely white, and there was a dense mem-

brane extending from the lower pupillary border to the corneal section.

The patient was again entered at the Brooklyn Eye and Ear Hospital on April 29th, where a deWecker discission was performed. On May 24th, vision was 20/40 plus with a +11.00D. sph.  $\approx$  +2.00D. cyl, ax. 160°, and these glasses were prescribed.

*Case 2.* A. M., a man, age 74 years, was admitted to the Brooklyn Eye and Ear Hospital from the out-patient service of Dr. Hargitt, on October 5, 1943, with a mature cataract in the right eye.

Physical examination revealed a soft systolic murmur at the aortic area, a blood pressure of 140/80, deeply stained but noncarious teeth, and an aphakic left eye. The blood Wassermann and urine examinations were negative for pathologic changes, and the smear from the eye taken before the operation was negative for pathogenic organisms.

Preoperative procedure was carried out according to the Bell technique. O'Brien block and retrobulbar injections were given and an ample section was made. As the section was completed there was a slight bulging forward of the iris. It was thought, however, that this was not of such degree as to contraindicate extraction by the intracapsular method.

An iridectomy was done, the lens capsule was grasped at the lower pole, and slight pressure was exerted just inside the limbus in order to dislocate the lens. This maneuver was about completed when vitreous began to present. The intracapsular technique was then abandoned and the capsule ruptured with the cystitome. In attempting to remove the lens by pressure and counterpressure, the lens was dislocated into the vitreous chamber. The lens was spooned out with the Weber loop and although more vitreous was lost, the total amount was not excessive.

Three conjunctival sutures, previously

prepared, were tied, no attempt being made to replace the iris pillars. A large air bubble remained in the anterior chamber. Atropine 1 percent, and metaphen 1:2,500 were instilled.

With the possible exception of the persistent air bubble in the anterior chamber, the postoperative appearance of the eye was not unusual until the fifth day. At this time it was noted that the entire cornea was becoming opaque and there was marked hyperemia of the entire conjunctiva. A diagnosis of postoperative endophthalmitis with hyalitis was made.

The appearance of the eye became progressively worse. On the ninth day, slitlamp examination revealed the cornea to be clear, and the gross appearance of the haziness was observed to be due to a gelatinous mass of grayish-green exudate in the anterior chamber, through which the iris could not be visualized. There was a small hypopyon in the bottom of the anterior chamber. On the 12th day, a small area of exudate in the upper border of the coloboma began to separate from the iris. Following this there was rapid recession of the inflammatory condition. Slitlamp examination on the 17th day showed the cornea to be clear. The iris structures were just visible. There was a membrane across the area of the coloboma which was believed to be lens capsule, and there was a large mass of yellow-green exudate in the vitreous. This vitreous exudate was rapidly absorbed so that on the 21st day there was only a small bead attached at the equator above the vitreous. At this time the patient was able to perceive the outlines of persons in good light at one-half meter.

The patient was discharged from the Hospital on the 26th postoperative day to be subsequently followed in the out-patient department.

Examination at this time showed many

vitreous floaters which seemed to consist of strands of exudate. There still remained a small bead of exudate at the equator above the vitreous, but this was much smaller than when previously observed. A fundus reflex could be obtained, but the details could not be made out. The conjunctival injection was disappearing and white sclera was beginning to show. The patient could count fingers if they were held above so that the patient could look through the upper part of the coloboma which was free of capsule.

The patient was again seen on November 11, 1942, at which time the vitreous exudate had completely disappeared and there were fewer vitreous floaters present. With a +10.00D. sph.  $\approx$  +2.00D. cyl. ax. 105° he could distinguish features at 20 feet.

The patient was readmitted to the Hospital in April, 1943, and a discission performed. At present, except for some vitreous opacities, the fundus is negative for pathologic changes. Vision is 20/10+, and he is able to read and write.

Treatment in this case was rather vigorous in spite of the advanced age of the patient. When it was noticed, on the fifth postoperative day, that an intraocular infection was impending, an intravenous injection of 5,000,000 typhoid germs was given. This was repeated on the sixth, ninth, and eleventh days, with increasing doses of 10,000,000, 15,000,000 and 50,000,000 typhoid germs, respectively. The reactions were only moderate, the highest temperature obtained being 101.4°F.

At the same time, sulfathiazole, gr. 60 daily, was given until the 20th day. Hot compresses were started on the sixth postoperative day and were given three times daily for 20 minutes, followed by the instillation of atropine sulfate 1 percent. Two days later, the hot compresses were discontinued and infrared therapy was instituted. The lamp was used di-

rectly on the eye at a distance of 12 inches. In this way a maximum temperature was reached in eight minutes. This was sustained for 12 minutes longer.

On the 14th day, 10 c.c. of sterile milk was injected intramuscularly, and this was given daily for the next eight days.

In addition to all this, one drop of dinin 3 percent was instilled morning and night.

## DISCUSSION

The two cases here reported are similar only in the fact that they were late postoperative infections, probably of endogenous origin; other than that their similarity ends.

In case 1, the operative trauma was no greater than that incident to the average cataract extraction. The second patient undoubtedly had severe operative trauma. Whether such trauma is a direct cause of infection is questionable and difficult to decide. Yet it is our impression that the percentage of infections following severe or prolonged operative trauma is not great. An iritis or an iridocyclitis is more likely to develop. However, there can be no question regarding the fact that, in such a delicate organism as the eye, excessive trauma should be avoided. Greater attention must be paid to the choice of operation, and one should change the operative procedure as the indication arises, rather than persist in carrying out a preconceived plan of operation.

In spite of the more advanced age of the first patient and the obviously poor physical condition, the infection remained confined to the anterior chamber. In the second case, on the other hand, the vitreous chamber seemed to be involved to a greater extent. At no time, according to the operator (L. J. D.) was the hypopyon more than minimal in amount. The recovery seems all the more remarkable, as rarely does such a large vitreous exu-

date become absorbed so that useful vision is obtained.

Therapy likewise was radically different in each case. In case 1, only a sulfonamide in large doses and over a prolonged period of time was given. In case 2, in addition to a sulfonamide, a large variety of measures, some of them heroic, was tried.

In the past, such heroic measures, without the use of sulfonamides, were rarely attended with success. One must therefore give credit in these cases to the sulfona-

mides for the results obtained. Ophthalmology owes a great debt to the discoverers of these valuable drugs.

An interesting sidelight on the administration of the sulfonamides is that in old people large doses and prolonged use of these drugs are extremely well tolerated. Certainly with these drugs in the armamentarium a good deal of despair is avoided if one is unfortunate enough to get a postoperative infection of the eye.

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### ESSENTIAL ATROPHY OF THE IRIS\*

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The present case of essential atrophy of the iris is presented for a double purpose. First the condition itself is rare enough to warrant reporting. Benedict—who with Henderson reported a case in 1940—has seen no other since the case reported by Barr and himself in 1934 (fig. 1). The second reason is that the condition was complicated by a "paper-dust" irritation of the cornea—somewhat common in packers at glass plants. The arrival at a decision as to just where the compensation stopped and the essential condition carried on presents a very nice problem.

To approach the case from its history, rather than its actual development, something should be stated about "paper-dust" irritation. During a year spent in Washington State, I had the opportunity to see many cases of "fir" poisoning. When a workman in the big mill would get a splinter in his hand or arm, especially

if of some size, the swelling in 30 minutes would be enormous. Moreover, when the worker would forget "fir" sawdust, which often became caught in the cilia

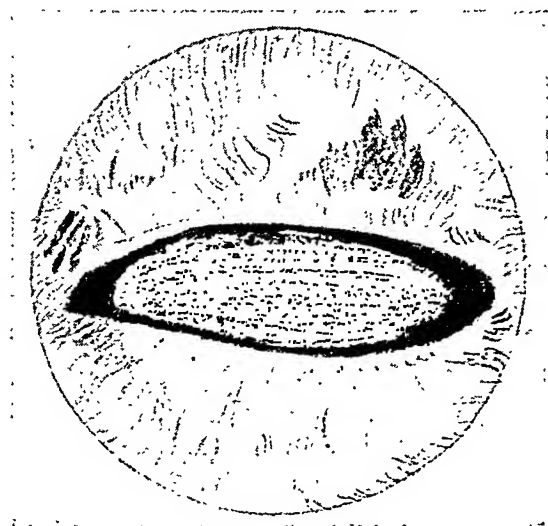


Fig. 1 (Ruby). Sketched from Henderson and Benedict's report of iris atrophy (Amer. Jour. Ophth., 1940, v. 23, p. 645).

of his nares, and would grasp his nose to "blow hard," he often showed up in 30 minutes with a purplish nose about the

\* Read before the Indiana Academy of Ophthalmology and Otolaryngology, April 28, 1943.

size of a Bartlett pear, and be a sick man. Finally, when a small spicule of fir sawdust was incarcerated in the conjunctival sac or in the cornea, the swelling, epiphora, and discomfort were out of all proportion to the size of the foreign body, or its location. Many of these spic-

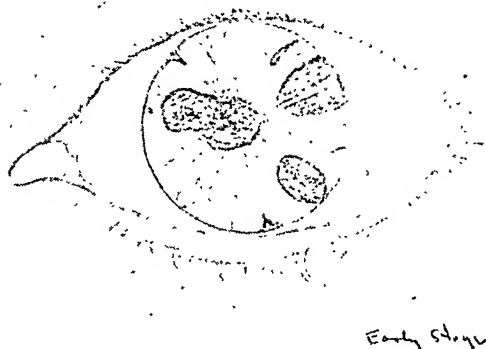


Fig. 2 (Ruby). The eye in the author's case—early stage, sketched from details given in the history.

ules were localized in the lid conjunctiva, upper or lower, by delicate palpation of the everted lid, not being visible by the naked eye. Removal of such particles, after being undiscovered for several days, would set up a reaction lasting as long as a week.

Now the pulp used in making the packing material to put between bottles or glass cans is a poorly cooked batch of fir waste products—often a whole batch of this material will be shipped with some still untreated fibers. Then these packers at the glass factory—frequently preceded by the men who unloaded the carload of pulp-paper—would begin to show up with typical fir-poisoned eyes. For two years, I was able to "date" a shipment of this kind.

As to the case to be reported: On November 15, 1941, Mrs. V. H., aged about 28 years, came to my office with the following history. In August she had a paper-dust condition in the right eye

which was treated by a local physician. The eye had never become well. She had worked at intervals until the 19th of October, when she had to stop. Treatment by removal of dust and other measures seemed temporary, and she finally was sent to a specialist (fig. 2). He reported her trouble to be purely a condition of the eye and not compensable. She disagreed, went to another office and was told all previous treatments were wrong, as well as the diagnosis. Her condition still did not improve. It was then that she was sent to me, some 90 days after the accident. Her complaint at that time was that the eye was in an awful shape—"draws and burns and hurts *all* the time; waters almost continuously." Use of the eye caused much redness; headache was rather constant, worse around the right eye, requiring many resting tablets.

Examination of the right eye at this time showed very red external margins, the bulbar conjunctiva to be injected. The anterior surface of the cornea was hazy and Bowman's membrane rough, below, at the 5:30-o'clock position. The iris

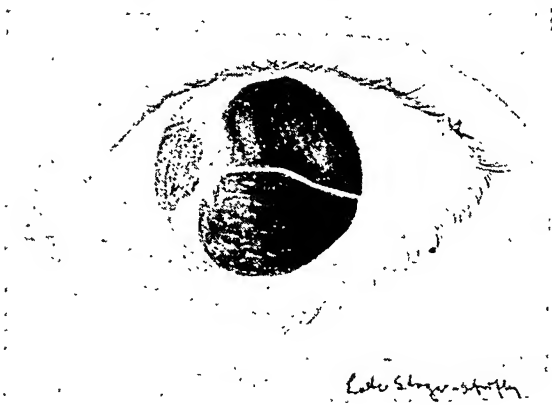


Fig. 3 (Ruby). Later development in the author's case, prior to enucleation.

seemed fixed and atrophied in several places. Tension was increased to fingers. Glasses obtained some months previous to incurrence of the disability gave no help.



The fundus showed little change and could be viewed through the distorted pupil as well as through two of the atrophic spots in the iris. During the next six weeks, repeated examinations showed variations in the haziness of the cornea, which, at times, would wrinkle ahead of the closing lids. Pontocaine ointment would give temporary relief to the symptoms. The vision and the headache were somewhat erratic. The tension was not improved.

In February, or 90 days after the patient had come under my observation, she went to Indianapolis for a visit and was referred to Dr. Masters for observation and treatment. She returned to me later in the spring with the condition unimproved. In June, the compensation question came to a head, for she had not worked since the previous October 19th. In the meantime, the colobomata in the iris continued to extend and enlarge so that a light held under the lower lid would give a beautiful picture of iris atrophy (fig. 3).

In August—settlement having been made out of court, in June, on the basis of 20 percent loss of vision—the patient decided to give up the eye, and it was enucleated on August 11, 1942 (fig. 4). Recovery was uneventful. The left eye has had absolutely no symptoms during the progress of the case.

**PATHOLOGIC REPORT**, as received from the Army Medical Museum.

**Gross:** The specimen consists of a partly collapsed eye measuring 24 by 25.5 by 23.5 mm. There are irregular thickening and opacity of the cornea and multiple colobomata of the iris. The eye is opened in the horizontal plane. The sclera is thin, the lens opaque, and the vitreous cloudy. The optic nerve is too short for cross section.

**Microscopic:** There is epidermalization of the corneal epithelium over a dense

pannus. Bowman's membrane is rather thick and prominent and, immediately beneath it, there is scarring of the corneal lamellae. Descemet's membrane is thick peripherally. A peripheral anterior synchia obliterates the filtration angle. There is some cystoid degeneration of the pigment epithelium of the iris and of the

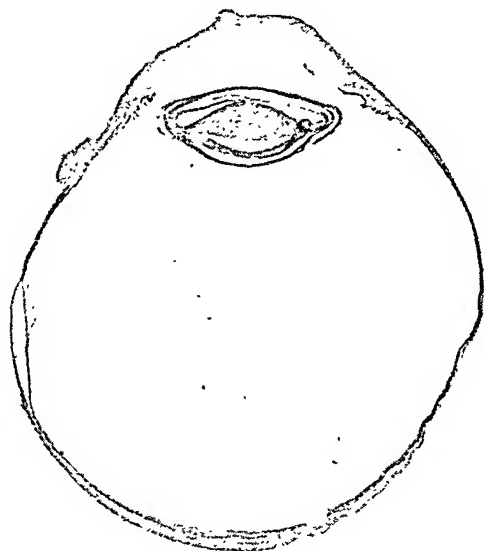


Fig. 4 (Ruby). Section of enucleated eye.

anterior ciliary body. On the temporal side, in the sections examined, only the anteriorly adherent peripheral portion of the iris remains, with pigment epithelium piled up on its posterior surface. On the nasal side there is a wide coloboma of the iris, and the pupillary portion shows ectropion uveae, vascularization behind the sphincter muscle, and loss of stroma in front of it. On this the stroma appears frayed at the margins of the coloboma. The lens does not appear to be desquamated. There is little hyalinization of the ciliary processes. The choroid is not remarkable. There are cystic degeneration of the retina at the ora serrata and slight edema of the outer plexiform layer at the macula, but otherwise significant changes are not seen in this coat. The lamina cribosa is depressed.

**Diagnoses:** Essential atrophy of the

iris; glaucoma, secondary: pannus degenerativus.

#### COMMENT

There are some 35 reports of cases of essential atrophy of the iris in the recent American literature. The condition is most often found in young adults, although others may have it. This may depend on the rapidity of its development. It is not a congenital condition, but progressive. Nor is it infectious, for in only one or two cases has it ever affected the second eye, and even these cases were not proved. The first authentic sign is a displacement of the pupil toward one side. This seems to result rather from atrophy on the opposite side than from excessive stimulation on the near side.

The cause of the atrophy has been much discussed. Some authorities considered glaucoma to be the cause, but the case of Barr and Fralick showed only a "24 point" reading on the Schiötz tonometer. The other theory points to a persistence of some of the embryonic activity in the eye—the process by which the hyaloid artery is destroyed, and the membrane dissolved in the pupillary area. Later in life, from some unknown cause, this process is reactivated, the atrophy, according to Casey Wood, seeming to start on the anterior surface of the iris, as the uveal layer often folds out over the edge of the coloboma. In a recent report glaucoma was considered to be the result of the atrophy. In the pathologic report of the eye, here described, there were adhesions from the base of the iris to the cornea, as well as some deposits of iris material about the periphery, shutting off the natural drainage from the eye. Other cases, however, showed no inflammatory condition, nor increase in white cells about any of the tissues. The final conclusions have been variously described as follows: de Schweinitz calls the condition an "abiotrophy or premature senility

with death of cells." Krickler calls it "a combination of embryogenic, cytolytic process of late development."

As to treatment of the case: Nothing except analgesics, local or general, seemed of the slightest value. When the eye was admittedly doomed, the greatest comfort was received by the local application of pontocaine and atropine. The latter was used upon the assumption that the "absolute-glaucoma" eye is painless, and this proved true in the eye, herein reported. The distress from light was relieved by a shield over the patient's glasses. Her vision dropped to 7/200 before enucleation. Following enucleation the refraction of the good eye was practically as it had been for two years. McKeown, in discussing treatment, states that whereas absolute glaucoma causes the blindness, it is secondary and not inflammatory; for the second eye practically always escapes.

As to the "paper dust" condition: The pathologic report showed that the cornea had been injured, at least once, maybe oftener. The "looseness" of Bowman's membrane—almost herpetiform in character—made the cornea more susceptible to the spicules of fir. The pannus could easily result from the repeated severe irritation.

#### CONCLUSIONS

1. The patient had "paper-dust" irritation.
2. She also had an underlying and previous essential atrophy of the iris.
3. The second condition made her suffering worse, and the duration longer.
4. While she would have suffered some, and would have lost the eye at approximately the same time, because of the atrophy, the reaction of the eye to the paper-dust irritation may have accelerated the other changes.

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## THE GEOGRAPHICAL DISTRIBUTION OF OCULAR INFECTIONS\*

WITH SPECIAL REFERENCE TO TROPICAL AND SUBTROPICAL COUNTRIES

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Experience has shown that it is important to become familiar with the distribution of infectious diseases in the active combat zones of the war. While McKinley's work on "A geography of disease"<sup>1</sup> and Mumford and Moore's "Preliminary report on parasitic and other infectious diseases of the Japanese mandated islands and Guam"<sup>2</sup> cover the subject of transmissible diseases in general, they contain very little information on infections of the eye. As observed by Lindner<sup>3</sup> and others during the first World War, epidemic and endemic dis-

eases of the eye may produce a high non-effective rate among armed forces.

Conjunctival infections are very common in tropical and subtropical countries "because of the presence of excessive heat, dust, and sunlight; crowding, filth, and lack of water; malnutrition and vitamin deficiencies. To these factors may be added the enormous number of flies and other insects, and the superstitious customs prevalent among the indigenous population."<sup>4</sup>

In table 1 the most important infectious diseases of the eye are arranged according to broad geographical zones, since it was impossible to obtain more specific information from the literature.<sup>5-10</sup>

\* From the Laboratory for Ophthalmic Research, Mount Zion Hospital. Aided by a grant from the Columbia Foundation.

TABLE 1  
GEOGRAPHICAL DISTRIBUTION OF OCULAR INFECTIONS

1. NORTH AFRICA (TUNIS, ALGERIA, EGYPT, ABYSSINIA, AND MOROCCO) AND WEST AFRICA

*Virus diseases:* trachoma, punctate keratitis, yellow fever (produces subconjunctival hemorrhages—West Africa); smallpox (blindness).

*Bacterial diseases:* acute conjunctivitis due to *Pneumococcus* or Koch-Weeks bacillus ("pink-eye"); *frambesia tropica* (yaws); recurrent fever (iritis, iridocyclitis, choroiditis); syphilitic keratitis; gonorrheal ophthalmia; angular conjunctivitis due to *Morax* bacillus; leprosy; *M. tuberculosis*; plague (corneal ulcers, iritis, iridocyclitis); gonorrheal ophthalmia.

*Parasitic infestations:* *D. latum* (*Sparganum mansonii*); filariasis (*F. loa-loa*—West Africa); trypanosomiasis (causes keratitis, purulent conjunctivitis, iritis, iridocyclitis, inflammation of eyelids).

*Flies and Insects (Myiasis):* Ant stings; worm similar to screw worm.

2. MADAGASCAR

*Virus diseases:* trachoma.

*Bacterial diseases:* syphilitic keratitis; "ulcus serpens" (*Pneumococcus*); leprosy; tuberculosis.

*Fungus diseases:* aspergillosis (corneal ulcer).

*Miscellaneous:* phlyctenular kerato-conjunctivitis.

3. CHINA, INDIA, AND INDO-CHINA

*Virus diseases:* trachoma; Samoan (inclusion) conjunctivitis; epidemic punctate keratitis (Ceylon, Madras, Bengal); smallpox (Madras, Ceylon, Cochin).

*Bacterial diseases:* acute conjunctivitis ("pink-eye"—Cochin, Bombay, Madras); gonorrheal ophthalmia (adults); conjunctivitis due to *Morax* bacillus; conjunctivitis due to *Staphylococcus*, *Pneumococcus*; blennorrhea neonatorum (*Gonococcus*); recurrent fever (iritis, iridocyclitis, choroiditis); plague (corneal ulcers, iritis, iridocyclitis—Madras, Ceylon, Cochin); syphilitic keratitis (Hanoi); "ulcus serpens" (*Pneumococcus*); leprosy; tuberculosis; *frambesia tropica* (yaws—Ceylon).

*Fungus diseases:* Polyps on conjunctiva due to *Rhinosporidium seceberi* (Madras, Ceylon, Cochin); *Rhinosporidium kincalyi* on lid (Madras, Ceylon, Cochin).

*Parasitic infestations:* *D. latum* (*Sparganum mansonii*—China, Annam, Tonkin); filariasis (China, Annam); blinding filariasis (Bombay, Madras); Kala-azar (*L. donovani*—Central China, Peiping); *T. solium* (cysticercus—China); *echinococcus granulosus* of orbit (China).

4. DUTCH EAST INDIES AND MALAYA

*Virus diseases:* trachoma; punctate keratitis; smallpox.

*Bacterial diseases:* acute conjunctivitis ("pink-eye"); conjunctivitis due to *Staphylococcus*, *Pneumococcus* (Java); conjunctivitis (*Morax* bacillus—Kuala-Lumpur); diphtheritic conjunctivitis; blennorrhea (*Gonococcus*) in adults; blennorrhea neonatorum (*Gonococcus*); serpiginous ulcer (*Pneumococcus*); tuberculous iritis; *frambesia tropica* (yaws); plague (Singapore); syphilitic keratitis; leprosy.

*Fungus diseases:* conjunctivitis due to yeasts (Java).

*Parasitic infestations:* *Filaria bancrofti* (elephantiasis of eyelids—Sumatra); leeches in conjunctiva.

*Flies and Insects (Myiasis):* Buffalo louse in conjunctiva.

5. SOUTH PACIFIC ISLANDS (INCLUDING SAMOA AND HAWAII)

*Virus diseases:* Samoan (inclusion) conjunctivitis (Tonga, Fiji group, Savaii, Manua, Samoan archipelago); vaccinal infections of lids; epidemic keratoconjunctivitis (Hawaii).

*Bacterial diseases:* *frambesia tropica* (yaws) Ellice and Tokelau Islands; conjunctivitis due to *Morax* bacillus (British East Indies); tuberculosis (Ellice and Tokelau Islands); leprosy; syphilis; catarrhal conjunctivitis with corneal ulcer (Ellice Islands).

*Fungus diseases:* conjunctivitis due to yeasts.

*Parasitic infestations:* filariasis of eyelids (Ellice and Tokelau Islands).

6. JAPAN AND MANDATED ISLANDS

*Virus diseases:* trachoma; lymphogranuloma venereum; inclusion conjunctivitis (Saipan).

*Bacterial diseases:* oculo-glandular tularemia; leprosy; tuberculosis.

*Fungus diseases:* *Aspergillus fumigatus* (kerato-mycosis).

*Parasitic infestations:* *D. latum* (*Sparganum mansonii*) in conjunctiva and eyelids; leeches in conjunctiva.

*Flies and Insects (Myiasis):* akamushi tick (carrier of tsutsugamushi virus) may bite eyelids.

## 7. AUSTRALIA, NEW ZEALAND, AND TASMANIA

*Virus diseases:* epidemic keratoconjunctivitis; Samoan (inclusion) conjunctivitis; trachoma.

*Bacterial diseases:* leprosy; tuberculosis.

*Parasitic infestations:* *D. latum* (*Sparganum mansonii*) causes tumor of eyelids.

## 8. PALESTINE, SYRIA, AND TURKEY

*Virus diseases:* trachoma; pappataci fever.

*Bacterial diseases:* acute conjunctivitis ("pink-eye") due to *Pneumococcus* and Koch-Weeks bacillus, conjunctivitis and keratitis due to the *Morax* bacillus; gonorrheal blennorrhea; leprosy; tuberculosis.

*Parasitic infestations:* leishmaniasis; malaria.

*Flies and Insects (Myiases):* sand flies.

## 9. MEXICO, CENTRAL AMERICA, AND CARIBBEAN ISLANDS

*Virus diseases:* trachoma; yellow fever (subconjunctival hemorrhage); typhus fever.

*Bacterial diseases:* "pink-eye," acute conjunctivitis due to Koch-Weeks bacillus (Colombia); recurrent fever (iritis, iridocyclitis, choroiditis); frambesia tropica (yaws—West Indies, Cuba); leprosy; tuberculosis.

*Parasitic infestations:* filariasis ("blinding filaria"—Guatemala, Mexico, Cuba).

*Flies and Insects (Myiases):* flies (Costa Rica, Colombia, Puerto Rico, Mexico); ant stings (Puerto Rico).

## 10. SOUTH AMERICA

*Virus diseases:* trachoma; yellow fever (causes subconjunctival hemorrhage—Brazil).

*Bacterial diseases:* frambesia tropica (yaws); plague (corneal ulcer, iritis, iridocyclitis—Brazil); leprosy; tuberculosis; "pink-eye" (Koch-Weeks bacillus—Brazil).

*Fungus diseases:* *Rhinosporidium seeberi* (conjunctival cysts); actinomyces. *Aspergillus niger* causes "sapiiranga" in Brazil.

*Parasitic infestations:* Leishmanian keratitis (Brazil); edema of lids from *Trypanosoma cruzi* (Brazil); *echinococcus granulosus* (Brazil, Argentina); *T. solium* (cysticercus—Argentina, Brazil); *D. latum* (*Sparganum mansonii*—British Guiana).

*Flies and Insects (Myiases):* Screw worms (gold bottle fly—French Guiana).

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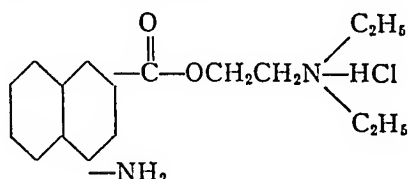
# NOTES, CASES, INSTRUMENTS

## THE USE OF NAPHTHOCAINE AS A LOCAL ANESTHETIC IN OPHTHALMOLOGY

ROY ALLEN STEWART, M.D.\*

Baltimore

Naphthocaine<sup>1, 2</sup> is the mono-hydrochloride of beta-diethylaminoethyl ester of 4-amino-1-naphthoic acid. Its structural formula is as follows:



It is a yellowish crystalline material soluble up to 2 percent in distilled water, making a clear pale-yellow solution with a pH of about 4.4. The solutions used for this clinical study contained sodium bisulfite, chlorotone, and adrenalin 1:50,000; the naphthocaine<sup>†</sup> was 0.2-percent, 0.3-percent, and 1.0-percent. The 0.3-percent and 1.0-percent solutions were superior in their anesthetic properties to the 0.2-percent solution, but even the 0.2-percent solution was superior to pro-

\* From the Baltimore Eye, Ear, and Throat Hospital.

† The naphthocaine was supplied by courtesy of Parke, Davis, and Co.

caine. I could not discern any difference in the anesthetic properties between 0.3-percent naphthocaine and 1.0-percent naphthocaine.

When 4-percent cocaine instillations and 5.0 c.c. of 2-percent procaine injections are used as a local anesthetic in intraocular surgery there appear to be definite disadvantages. When the superior-rectus suture is placed the patient usually has a definite pain. Likewise there is pain when an iridectomy is performed. Akinesia is often faulty. Postoperatively, the patient often has pain in the eye that has been operated on within a few hours or less time.

When 4-percent cocaine instillations and 5.0 c.c. of 0.3-percent naphthocaine injections are used in intraocular surgery there is usually no pain when the superior-rectus suture is placed, and no pain when an iridectomy is done. Akinesia is really excellent. The average length of time before postoperative pain begins is 8 to 10 hours.

At the Baltimore Eye, Ear, and Throat Hospital we have made a clinical study of naphthocaine as a local anesthetic in ophthalmology. The following list of operations under this anesthetic have been performed:

	Number of Cases	Amount Injected	Instillations
		c.c.	
Intracapsular cataract extraction	20	5.0	4% cocaine
Iridectomy	1	5.0	4% cocaine
Iridencleisis	3	5.0	4% cocaine
Lagrange anterior sclerectomy	1	5.0	4% cocaine
Posterior sclerotomy	1	1.0	4% cocaine
Walker operation for retinal detachment	2	8.0	4% cocaine
Enucleation	1	8.0	4% cocaine
Suture of lacerated lids	1	5.0	4% cocaine
Lacrimal probing	5	1.0	4% cocaine
Reese resection and Jameson recession	1	5.0	4% cocaine
Curretment of chalazia	15	0.5	0.5% pontocaine
Conjunctival plastic for symblepharon	1	2.0	0.5% pontocaine
Kuhnt-Szymanowski operation for ectropion	1	13.0	0.5% pontocaine

The striking features of local anesthesia with naphthocaine are its immediate anesthetic effect after injection, the excellent akinesia, the real anesthesia during the operation, and the long duration of the anesthesia. The Walker operation is a real test of a local anesthetic. In the two cases reported the patients complained of no pain during the operation and required only codeine 0.5 gr. and 10 gr. of acetylsalicylic acid 10 hours postoperatively. When this procedure was carried out with procaine the patient was rather uncomfortable and the postoperative pain somewhat severe.

Although naphthocaine works best when injected it has a good anesthetic effect upon instillation, and corneal foreign

bodies can be removed, tonometry and other minor procedures can be effected without pain to the patient. When naphthocaine is injected into the lacrimal sac by way of the canaliculus, lacrimal probing can be done with very little discomfort to the patient. In the cases reported no patient developed toxic symptoms,<sup>3-5</sup> nor any appreciable change in pulse, respiration, or blood pressure. The Nose and Throat Department has used 30.0 c.c. of naphthocaine for injection many times and there has been no reaction to the drug.

From this small experience with naphthocaine it would seem to be the best drug for obtaining local anesthesia in ophthalmology.

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#### NOMINAL DUCTION AND TRUE DUCTION POWER

JOSEPH I. PASCAL, M.D.  
New York

One of the striking points in Abraham's article on "Near horizontal phoria and duction tests" in the March, 1943, issue of the *American Journal of Ophthalmology* is the wide discrepancy in the adduction-abduction ratio at near in the normal group as found by him and as found by Berens *et al.* in their investigation. The latter found a ratio of practically 2:1 of adduction to abduction, while Abraham found a ratio of practically 1:1. However, these results may not be so far apart as

they seem if we take into consideration the difference between nominal ductions and true ductions. Nominal ductions refer to the amount of prism power, base out or base in, overcome without reference to an existing phoria; true ductions refer to the amount of prism power, base out or base in, overcome but with reference to an existing phoria. True duction power measures what has been called breadth of fusion and refers to a forced movement of the eyes inward or outward in order to maintain or regain single binocular vision.

To take case 1, table 1, as an instance. This patient had 6 delta of exophoria (I prefer the short term delta to the clumsy term prism-diopter). The nominal abduc-



tion was 20 delta. But the first 6-delta prism, base in, did not induce a *forced* movement outward in order to maintain fusion. It permitted a relaxation of 6 delta to the position of equilibrium. Beyond the 6 delta the base-in prism produced a forced outward rotation in order to maintain fusion. This amounts to 14 delta, which represents the true abduction.

The nominal adduction in this case was 19 delta. But the patient began the test with a forced inward rotation, a true adduction of 6 delta, to compensate for his 6 delta of exophoria. Therefore the total

true adduction was 25 delta. The ratio of adduction to abduction is as 25:14, nearly 2:1. If the amount of exophoria is added to the adduction and subtracted from the abduction, the ratio in most of the cases will be nearly 2:1. The fact that Berens's findings were made at a closer range, at 25 cm. to Abraham's 33 cm., may account for the somewhat greater relative adduction in the former set. At the closer point, the sense of nearness may be more effective in inducing the convergence activity.

*37 West Ninety-seventh Street.*

## SOCIETY PROCEEDINGS

EDITED BY DR. DONALD J. LYLE

### NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

October 5, 1942

DR. ISADORE GIVNER, *presiding*

#### STANDARDIZATION OF THE SCHIÖTZ TONOMETER

DR. ADOLPH POSNER presented an exhibit and demonstration on this subject during the instructional hour.

#### DISASSOCIATION OF THYROTOXICOSIS AND OPHTHALMOPATHY IN GRAVES'S DIS- EASE

DR. SAUL HERTZ stated that there are cases in which no correlation between the degree of ophthalmopathy and the degree of thyrotoxicosis in Graves's disease exists. Low degrees of thyrotoxicosis may exist with serious ophthalmopathy, and vice versa. Cases of serious eye disturbances require special handling both from the diagnostic and therapeutic point of view and must be considered apart from the ordinary cases of Graves's disease. The eye disturbances often improve with iodine therapy, but the best results

have been obtained with iodine and thyroid. Occasionally it has been necessary to add X-ray treatment to the thyroid. Thyroidectomy is definitely contraindicated in this type of case.

A recent survey by Dr. J. H. Means has indicated that, in a group of representative clinics, thyroidectomy preceded the orbital decompressions in over 90 percent of cases requiring orbital decompression. On the other hand, no orbital decompressions have been performed at the Massachusetts General Hospital Clinic for three years since the institution of the present policy of averting thyroidectomy in cases suspected of being in the special group of ophthalmopathic Graves's disease.

Pictures were shown to illustrate the difference between cases of the ordinary type of Graves's disease and those of the progressive or malignant exophthalmic type.

*Discussion.* Dr. Maurice Bruger stated that Dr. Givner and he had studied the effect of vitamins B<sub>6</sub> and E in eight patients with postthyroidectomy exoph-

thalmos. These vitamins were chosen because of their recognized value in some forms of muscular dystrophy. It was thought that there might be some influence on the myopathic changes in the extraocular muscles, the prime factor in the causation of exophthalmos. In addition, three patients were given ergotamine tartrate and one prostigmine bromide. Vitamins B<sub>6</sub> and E were without effect on the degree of exophthalmos or on the extent of the lid retraction. Ergotamine tartrate, however, improved the Dalrymple sign appreciably without altering the exophthalmos. Prostigmine bromide was without measurable effect.

Dr. Daniel Kravitz asked Dr. Hertz how he accounted for the exophthalmos when the ocular muscles were not enlarged.

Dr. H. M. Katzin asked Dr. Hertz to enlarge on the subject of treatment of malignant exophthalmos with X-ray therapy to the thyroid gland.

Dr. Hertz, in closing, said that from the medical point of view, it seems not unbelievable that one could have edema of the orbital tissues and that the muscles need not necessarily be involved. He cautioned that one has to be very strict in placing the patient in the category of malignant exophthalmos. His experience with X-ray treatment has been limited. It has been effective in a few cases in which iodine and thyroid therapy did not fully control the condition.

#### SURGICAL PROCEDURES FOR EXOPHTHALMOS IN HYPERTHYROIDISM

DR. EDMUND B. SPAETH stated that the surgical treatment of exophthalmos from thyrotoxicosis depends upon the degree of exophthalmos present, the rapidity of its progress, and the period at which it appears as a surgical situation, such as the stationary exophthalmos of thyrotoxicosis (regardless of whether or not a thyroidec-

tomy has been done), and that type of exophthalmos which follows after a thyroidectomy.

Other complications, such as oculomotor disturbances, retraction of the upper lid, conjunctival edema, and an endangered cornea from lagophthalmos are all additional factors, frequently of serious import. It is these complications, as they appear, that control the seriousness of the condition being treated; also they decide, to a very large extent, the type of surgery that is necessary in any given case.

Malignant or progressive exophthalmos can be treated successfully only by some type of orbital decompression. The subzygomatic route for this, it seems, is as satisfactory a procedure as is the transfrontal approach for the removal of the roof of the orbit. Anatomically there should be no choice between the two when considering this type of exophthalmos.

*Discussion.* Dr. John H. Dunnington stated that operations done for cosmetic reasons are often disappointing to the patient. They expect too much in spite of our efforts to depict the true picture to them. He has, therefore, been inclined to operate only when the lagophthalmos or other symptoms demand action. Recession of the levator as described by Goldstein will remove the disfigurement caused by retraction of the upper lid, and in his opinion its use should be restricted to cases manifesting a marked exposure of the sclera above the upper corneoscleral margin. Lateral tarsorrhaphy narrows the palpebral fissure satisfactorily, and he believes the best technique is that described by Wheeler. In this operation a tongue of tarsus denuded of its epithelium is inserted into the opposite lid. This operation gives an acute angle to the external canthus and is far superior to the rounded one that follows after the use of the Fuchs technique.

The selection of the lid from which the tongue is to be carved will depend upon whether one wishes primarily to lower the upper lid or to raise the lower lid. A tongue from the upper lid inserted into the lower lid narrows the fissure chiefly by lowering the upper lid, while the reverse is true when the tongue is taken from the lower lid and inserted into the upper lid.

Intermarginal adhesions afford the necessary protection for the cornea in cases of lagophthalmic keratitis and should be inserted prior to the onset of extensive chemosis of the conjunctiva and edema of the lids. In his experience retrobulbar drainage for a prolapsed chemotic conjunctiva has not been necessary. Gentle massage with a glass spatula combined with liberal use of an antiseptic ointment has proved sufficient in the majority of instances.

#### ORBITAL DECOMPRESSION FOR PROGRESSIVE EXOPHTHALMOS IN THYROID DISEASE

DR. JAMES L. POPPEN recounted surgical experiences in relation to orbital decompression for progressive exophthalmos in a series of 25 consecutive cases at the Lahey Clinic. He stated that there is an optimum time for the operation and that it should not be withheld until the development of chemosis and perhaps corneal ulceration. Indications for the procedure consist of progressive exophthalmos of high grade together with progressive visual symptoms and often changes in the optic-nerve head. The operation is not serious and, in his experience, there is no operative mortality. The technique of the Naffziger operation with slight modifications was described.

Procrastination is to be deprecated when visual loss is detected, inasmuch as all other palliative treatment has been of no effect. The only possible exception seems to be the preoperative determina-

tion of the basal metabolic rate, in order to determine whether Lugol's solution and possible excision of thyroid remnants should be considered.

The symptom of diplopia in relation to extraocular palsies should receive attention. While such a condition may persist to some degree or possibly result from the operation, it is usually amenable to minor operative treatment in those cases that do not clear up spontaneously. Following the operation there is immediate postoperative improvement in the exophthalmos and a gradual recession usually continues over a period of years.

*Discussion.* Dr. Howard Naffziger described the characteristic pathologic changes found in the ocular muscles in malignant exophthalmos. He emphasized the points that the condition of the muscles in the ordinary cases of exophthalmic goiter is not known and that muscle changes are not necessarily the same in cases of malignant exophthalmos. He described his technique of orbital decompression and stated that a broader exposure can be obtained than with the subzygomatic approach. One reason for confusion as to the presence or absence of exophthalmos has been failure to distinguish "stare," or retraction of the upper or lower lid, from protrusion of the eyeball. Exophthalmos can be confirmed only by careful measurement with the Hertel exophthalmometer. Unilateral exophthalmos speaks for orbital neoplasm, rather than thyroid disease. Soley has found that eyes of more than 50 percent of patients with toxic diffuse goiter became measurably more prominent after thyroidectomy, contrary to the clinical impression of most clinicians.

Dr. Martin Cohen stated that he regarded the Naffziger operation formidable and that he has obtained the same results with the Krönlein operation.

Jesse M. Levitt,  
*Secretary.*

CHICAGO OPHTHALMOLOGICAL  
SOCIETY

October 19, 1942

DR. LOUIS G. HOFFMAN, *president*

## CLINICAL PROGRAM

(Presented by the staff of Children's  
Memorial Hospital)

## SCIENTIFIC PROGRAM

THE PROBLEM OF RATING AMETROPIC  
VISUAL ACUITYDR. JAMES O. LEBENSOHN presented a  
paper on this subject.*Discussion.* Drs. Kronfeld, Jaeckle, and  
Lebensohn participated.

## SURGERY OF THE OBLIQUES

DR. SANFORD R. GIFFORD read a paper  
on this subject.*Discussion.* Drs. Mayer, Kronfeld,  
H. J. Smith, Selinger, and Gifford were  
the discussers.

Robert Von der Heydt.

COLORADO OPHTHALMOLOG-  
ICAL SOCIETY

October 24, 1942

DR. GUY HOPKINS, *presiding*TREATMENT OF CATARACT WITH LYM-  
PHOGOGUESDR. EDWARD R. NEEPER presented  
L. M., a woman, aged 42 years, who was  
first seen in February, 1937. She gave a  
history of failing vision in the right eye  
for the past 15 months. She also com-  
plained of having had eczema all her life  
and showed definite signs of allergy. The  
vision at that time was R.E. 20/200; L.E.  
20/20-4. Vision was unimproved with  
lenses. The right lens was cataractous  
throughout. The left lens had a posterior  
polar cataract about 2 mm. in diameter.  
Lymphogogues have been used once eachweek since that time. On July 8, 1942,  
examination showed that the right eye  
had a mature cataract, but the left lens  
had remained stationary.DR. NEEPER also presented the case of  
C. M. who had been under observation  
for a period of over 25 years. In 1933 she  
showed beginning cataracts, more marked  
in the left eye. Lymphogogues were  
started in November, 1934, and used  
once each week since that time. At this  
time vision, with correction, was normal.REMNANTS OF THROMBOSIS OF CENTRAL  
RETINAL VEIN, RIGHT EYEDR. FRITZ NELSON said that J. J. S.,  
a man aged 53 years, complained of sud-  
den loss of vision, right eye, two years  
ago. There was, however, partial return  
of vision. The left eye had always been  
normal. Examination showed remnants  
of a thrombosis of the central retinal  
vein, right eye, with the formation of  
a large number of collateral vessels on  
the surface of the disc. The patient had  
had difficulty in swallowing, especially  
cold foods, for many years.X-ray examination showed a large  
diverticulum of the esophagus. It was  
suggested that there is a causal connec-  
tion between thrombosis of the central  
retinal vein and the diverticulum, owing  
to compression. On the other hand fre-  
quent exposure to carbon monoxide may  
be a contributing factor in the cause of  
thrombosis.

## TUMOR OF OPTIC NERVE

DR. FRITZ NELSON presented R. C. E.,  
a woman, aged 43 years, who was first  
seen in April, 1942, with a brown, tumor-  
like mass, semispherical in shape, cover-  
ing the upper nasal third of the disc in  
the right eye and extending into the  
adjacent area. There was suspicion of a  
slowly growing malignant melanoma. No  
treatment was advised for the present,  
but close observation was recommended.

## CONTACT LENSES

DR. FRITZ NELSON said that C. A. J., a man, aged 47 years, had a pronounced keratoconus in both eyes. He was fitted with aspheric contact lenses in June, 1941, and since that time has been able to continue his occupation as a sheet-metal worker very satisfactorily.

## CATARACT EXTRACTION WITH COMPLICATIONS

DR. FRITZ NELSON presented L. S. S., a man, aged 58 years, who had had a cataract extraction, right eye, in August, 1940, with uneventful recovery. The left eye was operated on without iridectomy on August 4, 1942; there were no complications. He was released from the hospital August 12, 1942. An iritis developed on August 15th, followed by secondary glaucoma, which did not respond to treatment. On August 31st there was beginning panophthalmitis, with exophthalmos and chemosis. An Elliot trephining was performed on August 31st. A culture of the chamber fluid showed pure *Staphylococcus aureus*. Immediate medication was instituted, with sulfathiazole grams 4 as an initial dose, and grams 1.5 every four hours. There was complete recovery within three weeks.

## NEW GROWTH

DR. VON H. BROBECK said that L. B. C., a man, aged 61 years, gave a history of redness and new growth on the right eye of three years' duration. During this past summer there was some pain in the eye and blurring of vision. Examination revealed an irregular triangular growth on the temporal episclera which invaded the cornea over its outer third, with vascularization. Biopsy report showed an incipient basal-cell carcinoma.

*Discussion.* Dr. E. M. Marbourg remarked that clinically it resembled pemphigus.

## ISOLATED PARESIS OF THE SUPERIOR OBLIQUE

DR. GEORGE H. STINE and DR. K. H. CHAPMAN presented J. A. W., a man, aged 57 years, seen for the first time in September, 1942, with a history of having fallen from a ladder and striking the back of his head and shoulders. Diplopia was noticed immediately after the accident. External examination of the eyes was negative, except for left hyperphoria, with the deviation greatest on looking down and to the right, the left eye lagging slightly. There was a slight increase in the deviation when fixating with the left eye. Measurement of the deviation with the Lancaster red-green test showed about three arc degrees of vertical deviation in the primary position, with the deviation greatest in the lower right field, the left image also being tilted down and to the left. The fundus was normal in each eye. Examination revealed no other physical injuries. The patient was placed on potassium iodide, 10 drops, three times a day, and the left eye was occluded to avoid diplopia. In three months the patient complained of practically no double vision except when his head was tilted far backward. The vision was 1.3 in each eye.

Dr. Stine and Dr. Chapman reported another case, a man, aged 48 years, with a bilateral fourth-nerve paresis, following a kick in the head by a horse. The condition cleared up in four months' time.

The third case was that of a man, aged 51 years, who also fell from a ladder. He showed a slight paresis of the left superior oblique which was much improved in one month's time.

The fourth case was observed in a woman, aged 63 years, who developed diplopia suddenly one day. She showed symptoms of hypertension and arteriosclerosis. Examination of the ocular rotations and diplopia fields indicated paresis

of the right superior oblique, the diplopia increasing when the head was tilted to the right, whereas single vision was obtained on tilting the head to the left. There was considerable improvement in the diplopia in one month's time under potassium-iodide medication.

Dr. Stine pointed out the value of the head-tilting test after the method of Bielschowsky, which when positive was pathognomonic of superior-oblique involvement. This test could be done with the hand stereoscope held tightly to the face and rotated with it, using a horizontal line on a test card, half of which was green and the other half red, to identify it with the right and left eye, respectively.

#### GLAUCOMA AND UVEITIS

DR. GEORGE H. STINE said that J. P., a woman, aged 50 years, who had been under his care since December, 1941, complained of blurred vision of the left eye which had definitely become worse the past two weeks, accompanied by some deep pain. The vision of the right eye was also blurred. She had had some badly infected teeth extracted two weeks previously and had also been treated for a mild sinusitis.

The right eye showed a low-grade uveitis with a few gray keratitic precipitates, a few pigment deposits in the pupillary margin, a few cells in the aqueous, and some fine dustlike opacities in the vitreous. The fundus was otherwise negative.

The left eye was in a state of advanced simple glaucoma. There was no evidence of a uveitic process, now nor previously, in this eye. There was some glaucomatous atrophy and cupping of the disc.

The tension of the right eye had never been found to be above 26 mm. Hg (new Schiötz). The tension of the left eye was 65 mm. Hg (Schiötz) but was reduced to 23 mm. Hg by the use of pilocarpine and eserine. However, this reduction was not

maintained. The field of vision in the left eye showed a severe concentric contraction. The right visual field was normal. Iridencleisis was done on the left eye in December, 1941, with an excellent result, although the vision was not improved beyond the ability to detect hand movements at one meter. The vision of the right eye when first seen was 0.9 but was now reduced to 0.4. The general physical examination, including tests for syphilis and undulant fever, revealed no pathologic changes. The intradermal tuberculin test was positive to 0.005 mg. tuberculin. The patient has been under treatment with increasing doses of tuberculin; instillations of dionin and atropine; several intravenous injections of typhoid H antigen, dosage up to 60 million; Pregl's iodine packs; and Reese paracentesis, which have controlled the condition but little to date. Mild X-ray therapy to the eye was being instituted.

Walter A. Ohmart,  
*Secretary.*

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#### LOS ANGELES SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

October 26, 1942

#### ASTIGMATIC DETERMINATIONS—A CLINICAL COMPARISON OF METHODS

DR. JULIAN GINSBERG gave a summary of the astigmatic tests commonly used by ophthalmologists, with the conclusion that there is no universal astigmatic test for all problems in refraction and therefore all methods should be understood and combined for the best results.

#### MODIFIED PTOSIS OPERATION (with films)

DR. ORWYN ELLIS presented a procedure for the correction of ptosis based on the Motais's operation which was published in the proceedings of the

Pacific Coast Oto-Ophthalmological Society, 1942; also in this Journal (1943, October).

#### CYCLODIATHERMY IN GLAUCOMA

DR. CLARENCE H. ALBAUGH said that until recently successful glaucoma surgery was based on the conception of increasing the adequacy of aqueous escape. Furthermore, there was no advance of a major proportion in the type of surgery done in the past decade. Our obscure knowledge of the basic cause of glaucoma was to a great extent responsible for this situation. Also, it was as yet impossible to produce typical chronic simple glaucoma in laboratory animals and thus much of the surgical experimental work was limited to the human being. The idea of cutting down the amount of aqueous formed was by no means a new one; however, the means of doing such a thing safely was not in current use until relatively recently. Since the diathermy had become available and had been tested on the eye in procedures for separated retina, use could now be made of it in cases of glaucoma also. It should be emphasized at the outset that cyclodiathermy is not a panacea for glaucoma and should be used only in those cases in which other time-tested methods of treatment had failed. Perhaps the first use of the idea of cutting down the amount of aqueous formed was the cyclo-dialysis of Heine in 1905. Shahan and Post, in 1921, in this country attacked the ciliary body with the thermophore

and, in 1924, Verhoeff actually cut out a portion of the ciliary body. In 1940, Vogt reported the first destruction of the ciliary body with diathermy.

Drs. Dunphy and Albaugh used the following procedure: (1) Perforating cyclodiathermy; in this operation Walker points were introduced in two rows at 3 mm. and 5 mm. from the limbus over half of the globe. (2) Nonperforating; here a Weve flat electrode is applied in the same area but no perforations are made. We used atropine postoperatively. The complications were few and not serious. The operation was simple and did not appear to disturb the eye.

The advantages were that there was no collapse of the anterior chamber; iris and cornea were not disturbed; the patient was able to resume normal activity within 24 hours, and the danger of sympathetic ophthalmia was much less than in the usual surgery. Indications for the operation were: hemorrhagic glaucoma, aphakia with glaucoma, buphthalmos, occasionally primary glaucoma, and, depending upon the particular case, it could be assumed that about 60 percent of the cases would be successfully controlled; in another 10 to 15 percent the tension might remain elevated but the patient would be comfortable.

It was to be hoped that, although this was not a "cure-all" procedure, other new developments may be made along the same lines.

Harold F. Whalman,  
*Editor*



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*Author's proofs* should be corrected and returned within forty-eight hours to the *Manuscript Editor, Miss Emma S. Buss, 5428 Delmar Boulevard, Saint Louis 12, Missouri*. Twenty-five reprints of each article will be supplied to the author without charge. Additional reprints may be obtained from the printer, the George Banta Publishing Company, 450-458 Ahnaip Street, Menasha, Wisconsin, if ordered at the time proofs are returned. But reprints to contain colored plates must be ordered when the article is accepted.

## REHABILITATION OF THE WAR-BLINDED

Elsewhere in this issue Sir Ian Frazer's "Whereas I was blind" is reviewed. The account of his own experience and the founding and development of St. Dunstan's in the past 25 years may well serve as examples of what may be accomplished for our own war-blinded in this country.

At one time it appeared the Veterans Administration would be the organization in the United States that would take over the care of the war-blinded immediately upon release from the base hospital where care of the acute condition is to be completed. Now, however, a some-

what different plan is contemplated. It is understandable that an organization that will have to concern itself with ten million and more men cannot devote much time to the social rehabilitation of perhaps a thousand men, and will be content to see that the financial help provided by the nation is administered properly to this blinded group. For perhaps 20 percent of these this will be the only help that they desire, but an effort to provide cultural, social, and instructive aid to any who desire it and are capable of utilizing it must be made.

The latest plan for our men involves admission to one of two hospitals, one on the Atlantic and the other on the Pacific

coast, especially designated for medical and surgical care of those with eye injuries or eye diseases. As soon as possible they will be discharged to an eye rehabilitation center under Army direction where both Army and Navy patients will receive care.

This center will be near a large city where the patients may not only enjoy such cultural pursuits as are provided by the theater and concerts but also, and much more important, may have a chance to find out whether they are fitted for employment in certain of the industries. Arrangements will be made to give the blind man opportunities to try various types of work in order to discover his likes and his adaptability. It is in this center that the newly blinded will learn the first things about taking physical care of themselves, eating, shaving, smoking, and such matters. They will begin the study of Braille. They will have the constant companionship of someone trained in the care of the blind, with psychiatrists available who will give them the proper approach to the new lives that they must now lead. The first depression must be overcome. A renewed faith that life is still worth living must be kindled. At this point the relatives must be educated in the proper attitude toward blindness. The demoralizing effect of demonstrations of pity must be clearly presented and strongly deprecated.

The time to be spent in this preliminary training center will vary greatly with the individual. One of our boys, blinded in this war, who had been a newsdealer before the war, was convinced that he could return at once to his home and take up his employment again. He was even optimistic enough to believe that he could make more of a success of it because he was blind! That is true courage. A man like that need stay only a very brief time at a training center. He can be discharged

from the Army, his pension, which is a generous one, started, and arrangements made for such further study as he may wish to take at home. The most important problem in his case may well be that of his home folks, to see to it that they do not let their pity for him be obvious, to encourage his independence, and to let him feel that he is still one of them as before, and has not become a person apart because of his lost vision.

On the other hand, there will be those who have been completely shaken by their sudden loss, for whom months of mental rehabilitation is necessary. Some will show a natural adaptation for certain lines of work that are open to the blind, others none at all. Braille is difficult. There are many who cannot learn it, but this applies more to the old than to the group of war blinded. However, it would be ingenuous to think that the man who never did care for reading even when sighted is going to be enthusiastic about the study of Braille. No matter how much one may desire it and strive to give some men the broader education to fit them for lives of usefulness, there will always be a considerable percentage who are destined to be porch sitters. With a good pension, probably more money than any of them ever had before, they are going to be satisfied to do nothing constructive. It is only to be feared that some of their relatives will seek to live on the same pension!

The ideal program for rehabilitation of the war-blind is immediate care for their injuries or eye diseases under the best possible supervision with psychologic aid at once by a psychologist trained in care of the blind. This step should be followed by transfer at the earliest possible moment to a center for the blind for preliminary rehabilitation, as described.

The arrangements planned for our soldiers and sailors up to this point are good. From here on the ideal is to discharge the

men to environments where they would have equal opportunities for social, occupational, and educational growth. Here our program falls down because we have no one national organization whose business it is to follow these men and look after their welfare. They are discharged with money in their pockets, each his own man to do as he likes. That is as it should be; but he returns, presumably to his home, where the only technical help that he will have in his further rehabilitation will be such as his state provides. In some states this is good, in many it is poor, and in some there exists practically none.

As Sir Ian Frazier points out, "Ultimately of course the After-Care Department became practically the whole of St. Dunstan's. . . ." Through this channel England has kept in constant touch with all of her war-blinded. It is their alma mater, their guide, counsellor, and friend, their point of reunion. A special dormitory is set apart for those returning to visit. This is all of vast importance to these men. To be sure the United States is far larger than Great Britain, but the principle is the same and it would seem that either through Government or private agency, or through both, some such organization should be established in our country, primarily or at least ultimately to include all of our blinded. Through this means there would be an adequate follow-up of a program well started by the Army, and undoubtedly this would be of inestimable value toward returning this group to a normal life.

Lawrence T. Post.

### SELF-OBSERVATION OF RETINAL DETACHMENT

Patients are often skeptical regarding the extent to which physicians can sympathize with the symptoms and complaints of those to whom they minister. A fam-

ous western eye surgeon is reported to have stated that he never used on his patients any drug which he had not tried upon himself. There is room for argument that general adoption of such a rule might be beneficial.

It would naturally be out of the question to require every practitioner of a specialty to have personal experience of all that his patients endure in disease, whether medical or surgical. It may be supposed that, other things being equal, the most careful refractionists are those who have themselves suffered the inconvenience of uncorrected refractive errors. But, fortunately, few of us are called upon to encounter in our own persons the discomforts or tortures, the disabilities, the fears and hopes and disappointments associated with the onset, progress, and surgical treatment of glaucoma or retinal detachment.

The literature of ophthalmology presents a number of examples of self-observation in connection with eye disorders. The insidious development of glaucoma, and the process of adaptation to the blindness resulting from that disease, have been eloquently described by several ophthalmologists, notably Laqueur and Javal. There has been no dearth of description of the experiences connected with the gradual formation of cataract. Analogous studies have probably been published previously in relation to retinal detachment, although the present writer cannot just now lay hands upon any one of them.

An excellent description of personal experience with retinal detachment and its successful treatment comes now from the pen of a Brazilian colleague, identified to the world at large only by the initials "V. J.," but whose account is published with an introductory note by W. Belfort Mattos, of São Paulo, Brazil (*Arquivos Brasileiros de Oftalmologia*, 1943, volume 6, page 63).

"V. J.," having himself for years performed the diathermy operation for retinal detachment, was quite familiar with the symptomatology of the disease, and with the experiences of those who submitted to operation, as described by the patients. He is forty-five years old, and has ten diopters of myopia. He has had in the right eye two attacks of exudative choroiditis, which he attributes to a dental cause, and which have been treated focally and with subconjunctival injections of hypertonic sodium chloride.

In November, 1942, he suddenly developed a vitreous exudate in the left eye. This exudate improved quickly after attention to a dental granuloma, but V. J. noticed that in the upper outer sector of the visual field objects seemed to quiver slightly, and possessed a strange gleam as though covered by cellophane tissue. In the course of a few days this first symptom of detachment developed into a rapidly progressive narrowing of the visual field. Central vision had returned to normal, and the writer continued his daily practice of ophthalmology, including an operation for diathermy coagulation of retinal detachment.

V. J. records that he went to the office of his friend Pereira Gómez with the pupil dilated by homatropine. Looking in the appropriate direction he was able to place the eye so that the field of the examiner's ophthalmoscope included the probable site of the retinal tear, the point at which the patient had experienced his first symptoms of tremulous vision. The detachment was flat, with a V-shaped tear. V. J. says he "had waited all these days to confirm the rapid increase of the myopic retinal detachment, as distinguished from the slow and nonvarying detachment caused by choroidal tumor." The "cellophane tissue" reflexes and the phosphenes were no longer noticeable, but the narrowing of the visual field reached

almost to the macula. However, the vitreous exudate had disappeared and macular vision was still 0.8 with the myopic correction and under mydriasis.

The retinal tear was readily localized, corresponding to the field position 20 degrees upward and outward, and to the 65-degree level, and being 12 mm. distant from the limbus.

V. J. states that his greatest inconvenience at the time of operation was from lavage of the conjunctival sac and from the procedure of limbal localization. The retrobulbar injection, to which some patients object so strenuously, bothered him not at all. On account of the high myopia and the direction in which he was forced to look, in order to expose the operative field in the lower inner quadrant, he was able to follow with both eyes every step of the operation. Every time the fine electrode perforated the sclera the retinal stimulation was intense, producing a "heavenly paradise such as is imagined by children and the faithful; an enormous variety of lights of all colors, resembling a scintillating mother-of-pearl, clouded the whole vision. . . ."

At the end of the operation, he says, "I distinguished fingers with the operated eye, which cheered me considerably because the danger of an immediate intraocular hemorrhage was much in my mind." No step of the operation was painful.

Dealing with the fixed position required during convalescence, emphasis is laid by V. J. on the value, at such a juncture, of previous training in self-control. A surprising experience, not previously imagined, was "an exquisite subjective sense of surrounding objects, persons, and things . . . : distorted figures, with three or more arms and legs, . . . twisted bodies. . . . A drinking glass, for example, only resumed its natural form when I touched it. I made an effort to evoke agreeable

hallucinations and only succeeded in seeing the worst of the so-called futuristic paintings. . . . I judge that my preoccupation not to move my head or eyes was the cause of all the subjective phenomena. . . ."

V. J. found his most unpleasant experience in convalescence to be the necessity for maintaining immobility in bed, spending five days and nights in a single position being sometimes impossible. "I was only successful in remaining three days immobile in the bed and after that I passed the day in the chair and lay down only at night, making the change between these two positions very slowly without displacing the head from its ideal position." Sleep was always taken in right lateral decubitus.

After eighteen days V. J. resumed his ophthalmologic practice, with normal vision. He confesses that some of the rules usually imposed upon patients by himself and other oculists were disregarded, "not from indiscipline," but because he found them exaggerated. Whereas resting the eye and keeping the head immobile in the proper position are indispensable, "immobility of the bed does not help the patient at all if the operation did not close or block the retinal tear. . . . If the operation did not go well, the retina which at the first examination appeared perfectly attached begins to become detached after the first six or eight days. Hence the absolute necessity for determining the cause of the detachment, whether traumatic, myopic, syphilitic, tuberculous, and so on."

After seven months V. J.'s operated eye retained normal vision with correction, a visual field merely contracted a little in the upper outer quadrant by reason of the cauterizations, a few organized exudates in the vitreous, and no phosphenes or other subjective or objective symptoms pointing to recurrence.

W. H. Crisp.

## BOOK NOTICES

WHEREAS I WAS BLIND. By Capt. Sir Ian Frazier. Clothbound, 168 pages. London, Hodder and Stoughton, Ltd. Price 8/6.

This is a very readable story of a man blinded in the first World War as a boy of 18, who would never let himself be discouraged but went forward to make of himself an outstanding figure in England.

He describes his sensations and reactions from the onset of his blindness through his varied career. He became assistant to Sir Arthur Pierson, who was director of St. Dunstan's in its early years, and, upon the death of Sir Arthur, in 1922, succeeded him as director of that institute. The author had multifarious interests: From the directorship of St. Dunstan's he was elected to Parliament, where he served several terms, always acting in the interests of the blinded. He later had a connection with the British Broadcasting Company.

The book is valuable from many points of view, perhaps foremost of which is the reaction of the individual to blindness. It is a good directive for those who have to do with the rehabilitation of the blind. This subject is particularly pertinent in these days when the number of our war-blinded is steadily increasing. The book also gives an interesting account of the development of St. Dunstan's, and points out the important sphere of influence that this organization has, its greatest value being in its Aftercare Department. The volume will be of value to all ophthalmologists because they have frequently to deal with the blind individual, and their contacts with the patient in the early stages of his blindness will be important in coloring his entire future.

Lawrence T. Post.

STRABISMUS, ITS ETIOLOGY AND TREATMENT. By Oscar Wilkinson. Second Edition; 369 pages; cloth binding; illustrated. Boston, The Meader Press. Price, \$4.00.

This edition of "Strabismus" is presented by Dr. Oscar Wilkinson in collaboration with Dr. Richard W. Wilkinson. The first 115 pages are devoted to the history of strabismus, the theories regarding its etiology, and a discussion of the physiology of the ocular muscles and of the physiology of vision. The second section of 75 pages is devoted to the types of strabismus and the methods of measuring the deviations. The third section of 170 pages is divided into the non-operative and operative treatment of squint. The chapter on Orthoptics has been rewritten and demonstrates the usefulness of the amblyoscope in diagnosing and treating squint. The chapter on Operative Treatment emphasizes the importance of accurate measurements in diagnosis and their value in selecting the most desirable type of surgery. Excellent illustrative cases with histories and photographs are shown in the last chapter.

The authors have presented clearly and concisely a great amount of controversial material. At the same time their opinions, choice of methods, and their results have been recorded.

William M. James.

## CORRESPONDENCE

### TYPE FOR INCOME-TAX INSTRUCTIONS

January 19, 1944

To the Editor:

In the last few months many of my elderly patients, and even some of the younger ones, have complained to me bitterly about the illegibility of the type in which the various income-tax blanks, and

particularly the "Instructions" which accompany them, are printed. I have therefore written to a Congressman friend asking him to see to it that no matter shall be printed on either blanks or the "Instructions" in smaller type than 10-point single-ledged. My Congressman friend replies that the request appears to him perfectly reasonable and that he will do his utmost to see that, in the pending income-tax reform-bill, the suggested requirement shall be incorporated.

To me it seems especially fitting and proper that the requirement in question should be backed by the medical group whose function and duty it specially is to safeguard, so far as possible, the eyes of the nation. The present moment, too (when both houses of Congress are in session and earnestly considering such a reform of the income-tax law as will enable at least ordinary people, engaged in ordinary business, to fill out their blanks correctly by the exercise of ordinary common sense), also seems to me the particularly appropriate time for seeing to it that ordinary people with ordinary eyes shall be able to see for themselves just what the requirements are which they, under very heavy penalties, are called upon to meet.

Will not, therefore, each and every ophthalmologist write three letters—one to his congressman and one to each of his U. S. senators, urging him to work for the adoption in the pending income-tax bill of the requirement that nothing on the income-tax return-blanks or on the "Instructions" explaining such blanks shall be printed in smaller type than 10-point single-ledged?

This matter should be attended to now. Delay would be fatal to the idea.

Your sincerely,

(Signed) Thomas Hall Shastid.

# ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

## CLASSIFICATION

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|--|--|
| 1. General methods of diagnosis                        | 10. Retina and vitreous                                |
| 2. Therapeutics and operations                         | 11. Optic nerve and toxic amblyopias                   |
| 3. Physiologic optics, refraction, and color vision    | 12. Visual tracts and centers                          |
| 4. Ocular movements                                    | 13. Eyeball and orbit                                  |
| 5. Conjunctiva   | 14. Eyelids and lacrimal apparatus                     |
| 6. Cornea and sclera                                   | 15. Tumors   |
| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries   |
| 8. Glaucoma and ocular tension                         | 17. Systemic diseases and parasites                    |
| 9. Crystalline lens                                    | 18. Hygiene, sociology, education, and history         |
|  | 19. Anatomy, embryology, and comparative ophthalmology |

### 1

#### GENERAL METHODS OF DIAGNOSIS

Costi Garcia de Tuñón, Carlos. Presentation of a new umbralometer. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1942, v. 1, July, pp. 114-122.

The author's apparatus, illustrated only schematically in the article, includes a four-volt lamp, a battery with variable resistance, a collimator, a pair of Nicol prisms, and the necessary supports and other accessory details. By rotation, the Nicol prisms serve as a means of obscuration, which reaches its zero point with complete crossing of the prisms. The advantages claimed for the apparatus are: continuous control of the intensity of the current and of the mechanism of obscuration; elimination of the factor of accommodation; the possibility of making observations in the presence of low visual acuity; and the basing of the measurements, not upon light perception, but upon the "minimum perceptible," which affords greater sensitivity and greater rapidity of investigation. (2 illustrations.)

W. H. Crisp.

Craik, K. J. W. Specifications for dark-adaptation tests. *Brit. Med. Jour.*, 1943, May 22, p. 632. (See Section 10, Retina and vitreous.)

Drews, L. C. Further observations on autofunduscopy (auto-ophthalmoscopy of Eber; Purkinje figure of Walker). *Amer. Jour. Ophth.*, 1943, v. 26, Nov., pp. 1143-1154; also *Trans. Amer. Ophth. Soc.*, 1942, v. 40, p. 370. (2 drawings, references.)

Krimsky, Emanuel. Graphic representation of binocular findings. *Amer. Jour. Ophth.*, 1943, v. 26, Nov., pp. 1199-1204. (7 graphs.)

Oak, Lura. The Massachusetts vision test, an improved method for school vision testing. *Amer. Jour. Public Health etc.*, 1942, v. 32, Oct., pp. 1105-1109.

Considerations on the system of testing children's eyes in Massachusetts schools, regarding the inadequacy of Snellen test type, as to the proper test-type distance, and as to the type of illumination led the author to the conclu-



sion that the validity of the test might be increased through selection and training of qualified persons, the reliability of records being further increased by improvements in material and methods with a view to minimizing opportunities for memorization and to calibrating a standard of illumination upon the charts. The new method now available for general use is designed to bridge the gap between present inadequate provisions and the time when the eyes of all children will, it is hoped, be examined by qualified eye specialists. Administration of the test requires an average time of  $2\frac{1}{2}$  minutes for children eight years of age or older. The test kit consists of the standard Luckiesh-Moss illuminator, the improved form of Snellen test type, a house chart mounted on a frame with an electrical tester, spectacles with plus spherical lenses, others with Maddox rods, and a central switch for controlling the lights. It further contains tests for latent hyperopia and muscle imbalance.

Melchior Lombardo.

Ramsay, A. M. *The ophthalmoscope in clinical medicine*. Brit. Med. Jour., 1943, June 5, p. 685.

With the aid of the ophthalmoscope the clinician is able to observe the physiologic and pathologic processes in the eye. Especially the effects of a disordered metabolism on the cardiovascular system can be detected at the earliest onset. The information thus gained by the clinician may be likened to the reports obtained from the laboratory. Like laboratory reports, the ocular findings can be properly evaluated only when they are correlated with general symptoms of the disease.

R. Grunfeld.

Riddell, W. J. B. *On testing dark adaptation*. Glasgow Med. Jour., 1943,

v. 21, June, pp. 149-157. (See Section 10, Retina and vitreous.)

Sugar, H. S. *A new material for anterior-segment impressions*. Amer. Jour. Ophth., 1943, v. 26, Nov., pp. 1210-1211.

Yudkin, J., and Ferguson, A. A. *critique of the Bishop Harman test for night vision*. Brit. Med. Jour., 1943, May 22, p. 632. (See Section 10, Retina and vitreous.)

## 2

### THERAPEUTICS AND OPERATIONS

Bertotto, E. V. *Evipan-sodium in ocular surgery*. Anales Argentinos de Oft., 1942, v. 3, Oct.-Nov.-Dec., p. 204.

The use of evipan and its advantages in ocular surgery are discussed. The author's experience with one case was satisfactory. Eugene M. Blake.

Borak, J. *X-ray therapy of inflammatory and neoplastic diseases of the eye*. Amer. Jour. Ophth., 1943, v. 26, Nov., pp. 1170-1174. (11 figures.)

Fleming, Norman. *Iontotherapy (ionic medication, iontophoresis, ionisation) as an aid in ophthalmic therapeutics*. Brit. Jour. Ophth., 1943, v. 27, Aug., pp. 354-367.

Poor results obtained by the old methods of iontotherapy are blamed upon too strong currents, too strong solutions and too long applications. An apparatus is described and illustrated in which the power is derived from small batteries, ensuring that the milliamperemeter needle never indicates more than two milliamperes. The instrument is so constructed that positive ions such as calcium and zinc are introduced into the eye, and it is provided with a reversing switch for introducing negative ions such as salicylates.

Cases of conjunctivitis are reported, both acute and chronic, in which iontotherapy gave excellent results. Corneal ulceration and herpes ophthalmicus, as well as iritis, episcleritis, and scleritis, also respond favorably to iontophoresis. Also reported are a case of retrobulbar neuritis and one of embolism in which the outcome of treatment with ionic medication was satisfactory. The application used most often was six parts of calcium chloride (1 to 500) with one part of adrenaline hydrochloride (1 to 10,000). Treatment to the eye itself is usually not given for more than two minutes; to the everted eyelids for not more than one and a half minutes; and to the closed lids for not more than five minutes. A small quantity of zinc sulphate (1 to 400) is added to the calcium solution when there is loss of epithelium. Silver nitrate (1 to 1,000) or soluble prontosil (1 to 10,000) is added where a powerful antiseptic is required. Atropine, acetylcholine, histamine, quinine, eserine, pilocarpine, iodides, salicylates, and other drugs may be used.

The principal feature of treatment by iontotherapy is reduction of congestion and so of inflammation generally. The claims of success in treatment of deep as well as of superficial inflammation are based on experience gained in the treatment of about one thousand cases during the past ten years. Iontotherapy is likely to be of particular value in the treatment of war casualties. (4 figures, references.)

Edna M. Reynolds.

Frey, Guernsey. "Through evil, good." *Amer. Jour. Ophth.*, 1943, v. 26, Nov., pp. 1208-1209.

Gallo, L. A. Use of dental absorbent rolls in ocular surgery. *Anales Argen-*

*tinios de Oft.*, 1942, v. 3, Oct.-Nov.-Dec., p. 210.

Gallo employs dental absorbent rolls in ocular surgery and recommends them to others. They come in several sizes and are sterilized by placing in oxycyanide solution, 1 to 1000, to which is added 50 drops of formol.

Eugene M. Blake.

García Miranda, Antonio. Importance of the slitlamp in the study of starvation conditions. *Arch. de la Soc. Oft. Hisp-Amer.*, 1942, v. 1, July, pp. 108-113. (See Section 17, Systemic diseases and parasites.)

Hughes, W. L. Water bath for maintaining proper temperature of eye-irrigation solutions. *Amer. Jour. Ophth.*, 1943, v. 26, Oct., pp. 1089-1091. (3 illustrations.)

Paula Santos, B. On the anti-infectious action of the sulfanilamides in ophthalmology. *Arquivos Brasileiros de Oft.*, 1943, v. 6, April, pp. 25-37.

The author, whose article is accompanied by five pages of bibliography, reviews the literature of the subject and considers the three modes of introduction of these drugs, namely the parenteral, the oral, and the local. With some other writers, he is disposed to take a conservative view as to the benefits to be derived in trachoma. In this disease he regards the action of the sulfanilamides as relating particularly to secondary infection, and only indirectly to the trachoma itself. He finds that, as indicated by the slitlamp, the limbal and conjunctival follicles are reduced but do not disappear. In some exceptional cases, treatment for as long as a year failed to yield results.

W. H. Crisp.

Pokrovsky, A. I. Remarks on ocular war surgery. *Viestnik Oft.*, 1943, v. 22, pt. 2, p. 3.

This is a plea for the more extensive use of fat implantation in plastic surgery of the lids. Although first proposed by Silex in 1896, its use is not so widespread as the author believes it deserves to be. It is particularly indicated in retracted scars of infected wounds of the lids, in which the skin although not shortened is drawn in and adherent to the periosteum. The deformity of such subcutaneous cicatrices can be relieved by freeing the skin from the periosteum and interposing between it and the subcutaneous tissue a layer of fat. The cosmetic appearance of disfiguring cutaneous transplants can be improved by padding them with a layer of fat. Four cases illustrating the effectiveness of fat transplantation in such cases are briefly reported.

Fat implantation is also useful in bony defects of the orbit caused by orbital injuries, or slowly growing orbital neoplasms. The retraction of the lids caused by such defects can be remedied by implantation of fat. The fat fills in the defect, does away with the retraction of the cicatrices, and improves the cosmetic appearance of the lid folds. It should be kept in mind that fat has no resistance to infection, and its implantation should not be attempted until infection has run its course.

The author also makes a plea for careful primary repair of lid injuries. While the general rule is to introduce no sutures in field stations, in injuries of the lids this rule does not apply. The lids are very resistant to infection, and primary sutures restoring the normal position and contour of the lids will save the injured person many subsequent plastic procedures. The conjunc-

tiva too is resistant to infection; and in injuries of the orbit and eyeball, requiring enucleation of the eyeball, the orbital and conjunctival wounds should be properly coapted and repaired so that an artificial eye may be worn subsequently. The author deplores the frequent performance of enucleations without attention to orbital and conjunctival wounds, so that symblepharon and obliteration of the conjunctival sac necessitate subsequent operations.

Another procedure advocated by Pokrovsky is that of multiple conjunctival incisions parallel to the lid margin for the enlargement of a shrunken conjunctival sac. After such incisions the introduction of a large prothesis lubricated with cod-liver oil leads to the epithelization of the conjunctival wounds, with permanent enlargement of the socket.

Ray K. Daily.

Post, L. T., and Robertson, E. N. Intravenous pentothal-sodium anesthesia in ophthalmology. *Amer. Jour. Ophth.*, 1943, v. 26, Nov., pp. 1155-1163. (One table, references.)

Scott, G. J. Effectiveness of sulfonamides when applied locally to the eye. *Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, pp. 3-13.

The author describes the effectiveness of the sulfonamides when used locally in ophthalmology as reported by research workers. With this as a basis he discusses the clinical use of the drugs. The sulfonamides are bacteriostatic except in very high concentration. The general defense mechanism of the body must be stimulated by specific or nonspecific measures. Oral or parenteral administration is indicated in infections of the orbit, lids, or conjunctiva, which can be reached through the blood stream in a concentration of 5 to 10 mg. per 100 c.c.

In treatment of an avascular structure such as the cornea the concentration of the drug must be aided by some form of local application. The value of purely local treatment is in prevention of infections of the eye in first-aid treatment of industrial injuries. In local treatment of acute infections, satisfactory results have been obtained only where the local applications were used at hourly, half-hourly, or even 15-minute intervals. (5 tables, 2 illustrations, references.) Beulah Cushman.

Sorsby, Arnold. **Ocular pharmacology of the sulfonamides.** Trans. Ophth. Soc. United Kingdom, 1942, v. 62, pp. 15-33.

From a review of the experimental use of the sulfonamides, the author concludes that clinically sulfapyridine seems the most effective in the eye. The dosage should be calculated for each patient on the basis of body weight, to maintain the optimum concentration of 10 mg. per 100 c.c. in the blood. The ocular complications of sulfonamide therapy are transitory myopia, retinal hemorrhages, optic neuritis, and conjunctival reactions. (Bibliography.) Beulah Cushman.

Thygeson, P., and Stone, W. Jr. **Sulfonamide therapy of ocular infections.** New York State Jour. Med., 1943, Aug., p. 1409.

Sulfadiazine, because of its low toxicity, is the drug of choice for oral administration in most ocular infections. The infections responding rapidly to oral sulfonamide therapy included gonorrheal, conjunctivitis due to trachoma, acute dacryocystitis, and corneal ulcers due to streptococcus hemolyticus and pyocyanus. Slow in response were blepharitis, conjunctivitis, and corneal ulcers due to staphy-

lococcus aureus. No response was found in tuberculosis, hemolytic streptococcus infections, pemphigus, virus infections, and sympathetic ophthalmia.

Local sulfonamide therapy is employed with success in superficial infections including blepharitis, conjunctivitis, and corneal ulcerations. Sulfathiazole ointment in blepharitis and conjunctivitis and sulfadiazine powder in corneal ulcerations seem to give the best results. Combined oral and local therapy should be used in severe infections. (3 tables.)

Gertrude S. Hausmann.

Von Sallmann, Ludwig. **Penicillin and sulfadiazine in the treatment of experimental intraocular infection with pneumococcus.** Arch. of Ophth., 1943, v. 30, Oct., pp. 426-436.

Various types of pneumococcus were inoculated into rabbit eyes and the results of treatment with sulfadiazine and penicillin were observed. It was found that infections caused by D. pneumoniae type III and type X were not stopped or were only temporarily improved by intensive local and systemic treatment with sulfadiazine. Severe intraocular infection by types III, X, and VII was usually checked by local treatment with penicillin. Infections caused by injection of types III and X with simultaneous injury to the lens capsule were treated successfully with penicillin in most instances. The iontophoretic introduction of the penicillin salts in 0.1 and 0.25 percent solutions was occasionally more effective than the corneal bath of a 0.25 percent solution. Repeated applications of a 0.25 percent solution by iontophoresis caused large abrasions of the cornea which healed without opacity. Strains of pneumococcus types VI, XIV, XIX,

and XXIII showed in vitro the same sensitivity to penicillin as the strains used in the rabbit experiments. (Bibliography.) John C. Long.

Wiener, M. Transplantation of preserved tissue in ophthalmic surgery. Jour. Michigan State Med. Soc., 1943, v. 42, Jan., p. 53.

The author presents a very interesting detailed account of the subject as regards corneal and conjunctival tissue. He describes in detail his technique of conjunctival implantation. He believes that preserved heterogeneous implants may be of value in plastic surgery wherever mucous membrane is needed.

T. M. Shapira.

### 3

#### PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Burian, H. M. A visual phenomenon related to binocular triplopia. Amer. Jour. Ophth., 1943, v. 26, Oct., pp. 1084-1086. (References.)

Burton, E. W. Progressive myopia: a possible etiologic factor. Trans. Amer. Ophth. Soc., 1942, v. 40, pp. 340-354.

Myopia is defined and the various theories advanced in the literature are reviewed. Particular emphasis is placed on the mechanical theories of myopia. The role of the orbicularis muscle in progressive myopia is discussed and a method of clinically testing the strength of the muscle is presented. Axial myopia was experimentally produced in young rabbits by mechanically constricting the globe at its equator with a tight silver wire. The intraocular pressure was thus elevated a reasonable amount, producing anteroposterior elongation of the eyeball.

The author concludes that frequently myopes who are undercorrected or who wear no correction at all resort to the habit of squeezing the eyelids together in order to make the diffusion circles smaller. When myopia is fully corrected, distant vision is distinct and there is less tendency to squeeze the lids together. Fully corrected myopia seems to show less tendency to progress than that which is only partially corrected. Contraction of the orbicularis muscle probably causes an increase in intraocular pressure which, if maintained over a long period of time, may cause stretching of the sclera not only in the very young, but also in older individuals if the sclera is already weakened. Elongation of the anteroposterior diameter of the eyes of rabbits can be produced by increasing the intraocular pressure. (7 illustrations, bibliography.)

David O. Harrington.

Elder, J. H. Effectiveness of vitamin A in the treatment of defective color vision. Science, 1943, v. 97, June 18, p. 561.

Sixteen college students who had defective color vision were given 25,000 units of vitamin A daily for eight weeks. One of the students took 250,000 units daily. Fourteen students, including the one just mentioned, showed no improvement whatsoever. Two students achieved perfect scores and passed the Army-Air-Corps tests. These two, however, had very slight defects.

A second experiment was made with 58 subjects who received 50,000 units of vitamin A every second day for eight weeks and were obliged to swallow the capsules under supervision. Of the 41 persons who finished the course of treatment, not one showed any im-

provement. The author draws the conclusion that vitamin A fails to produce any significant improvement in color sensitivity, although in a negligible few instances, where the defects of color vision are of minor degree, it may improve the color vision slightly.

R. Grunfeld.

Judd, D. B. **Color-blindness and the detection of camouflage.** *Science*, 1943, v. 97, June 18, p. 544.

The author analyzes the conditions under which a color-blind and a color-screened normal observer respectively could detect a camouflaged position.

R. Grunfeld.

Low, F. N. **Studies on peripheral visual acuity.** *Science*, 1943, v. 97, June 25, p. 586.

Peripheral visual acuity was measured on the perimeter by the use of Landolt's broken circles with breaks of various sizes. The test objects were placed at 30 and 60° and at the four points of the compass. The size of the break in the smallest circle successfully identified four times in succession was scored. The peripheral visual acuity thus measured was found to be an independent factor. It did not correlate with age, sex, central visual acuity, or color vision. The second eye, generally, scored better than the first. A 6-percent improvement was recorded when the test was repeated and a 16-percent gain noted when the test was taken for the third time. This indicates that peripheral visual acuity can be trained.

R. Grunfeld.

Luckiesh, M., and Moss, F. K. **Comparison of a new sensitometric method with usual technics of refraction.** *Arch. of Ophth.*, 1943, v. 30, Oct., pp. 489-493.

This sensitometric method of refraction

is a subjective method in which the dioptric power producing maximal visibility is determined with the Luckiesh-Moss sensitometer. In this method relative accommodation is avoided by the elimination of all adequate optical stimuli for accommodation from the entire binocular field. Satisfactory control may not be obtained by the fogging method, as the stimulus for relative accommodation increases as the plus power is decreased. The sensitometric method involves binocular parafoveal stimuli sufficient to insure convergence at a point in the plane of the test object. However, it has been shown that this is an inadequate stimulus for relative accommodation. In the usual methods of testing, monocular and foveal stimuli for accommodation as well as for convergence are present.

Sensitometric observations have demonstrated that the normal eye is myopic in the absence of stimuli for relative accommodation and that it may become emmetropic when such stimuli are present. In formulating a dynamic definition of emmetropia, the authors state that this condition exists when all points within the range of habitual near vision and the retinas are conjugate without the exercise of relative accommodation (and with the static addition), while more distant points may become conjugate by the exercise of negative relative accommodation.

John C. Long.

Martin, J. E. **Atropine glaucoma.** *Brit. Med. Jour.*, 1943, May 22, p. 631. (See Section 8, Glaucoma and ocular tension.)

Pascal, J. I. **Cylinder retinoscopy—simplified.** *Amer. Jour. Ophth.*, 1943, v. 26, Dec., pp. 1304-1308.

Sloane, A. E. Refraction clinic. *Amer. Jour. Ophth.*, 1943, v. 26, Nov., pp. 1212-1215.

Stocker, F. W. Pathologic anatomy of myopic eye with regard to newer theories of etiology and pathogenesis of myopia. *Arch. of Ophth.*, 1943, v. 30, Oct., pp. 476-488.

The usual pathologic changes encountered in high myopia are discussed, together with the detailed findings in a myopic eye of a fifteen-year-old boy. Thinning of the posterior pole of the globe has been found almost regularly in severe myopia, and a flat arrangement of the scleral fibers is generally found in such cases of thinning. Temporal conus is usually present but does not generally appear until the second decade. Along with temporal conus in cases in which the retina overlaps the choroid toward the optic disc, the nerve fibers corresponding to the most temporal part of the optic nerve turn around the edge of the retina and form a "temporal nerve-fiber loop". Supertraction of the retina over the nasal part of the disc is often found in high myopia. Atrophy of the choroid occurs but usually does not develop until later in life, at which time the progress of the myopia is relatively stationary. Retinal changes appear to be largely associated with atrophy of the choroid.

The conventional theory of the causation of myopia considers that the sclera, choroid, and retina are stretched by some force. The author adheres to the theory of Vogt that the retina is the determinative factor in the size of the eye. If the retina has a stronger tendency to grow than the sclera, the latter may be stretched. The "push" delivered by the developing retina is to be considered in the biological rather

than in the mechanical sense. It has been shown pathologically that in young myopic eyes there may be considerable stretching of the sclera while the retina remains normal. Retinal changes develop late and are secondary to choroidal atrophy. It seems possible that each coat of the eye has its own inherited potential of growth. In the majority of persons, there exists enough coördination of growth to bring about the development of an eye which is emmetropic or nearly so.

John C. Long.

Vishnevsky, H. A., and Flekkel, A. B. A study on the recognition of colored signals by persons with defective color vision. *Viestnik Oft.*, 1943, v. 23, pt. 1, p. 16.

Defective color vision was found in 8 to 9 percent of applicants for schools of aviation, in 1 percent of the flying personnel and aviation cadets, and in 14 percent of applicants rejected because of ocular defects. In order to determine to what extent it would be possible to utilize color defectives in aviation, 41 persons with color defects were given a laboratory examination and a practical test on recognition of the colored signals which are very important in night flying. Colored signals are used to avoid collision in formation flying, to make contact with the ground, and to mark interferences in landing. The test objects were colored flares used in aviation, aerial navigation lights, and colored signals observed from the ground and from the air. The laboratory examination consisted of tests with the Stilling, Ishihara, and Rabkin plates, and with the Nagel anomaloscope. The test with flares was carried out at night on a river bank. The recognition of colored signals on the ground was recorded



from a distance of 1,000 meters, and then at intervals of 100 to 500 meters. Recognition in flight was tested at 1,000, 800, and 600 meters. The signals were white, red, yellow, green, and blue.

The data show that recognition of green, red, and yellow flares is difficult even for normal trichromates, three out of nine calling yellow flares red. Among persons with anomalous deuteranopia the errors were very high, only two out of 29 giving the correct answers. Since each colored flare has a definite meaning, confusion is obviously dangerous in military aviation. Recognition of colored signals is very poor in anopes and anomalous deuteranopes, even at a distance of 500 to 600 meters.

The conclusions are that classification of defective color vision is difficult with colored plates, and can best be done with the anomaloscope. The correlation of the laboratory data and practical tests shows that the largest number of errors is made by anopes. Persons with identical defects in color vision varied in their responses to the practical tests. Recognition of aviation signals differs from railroad and automobile signals in the small visual angle under which the lights are seen and in the required rapidity of recognition. Proper response to colored signals in aviation requires correct recognition and identification of the color.

Ray K. Daily.

#### 4

##### OCULAR MOVEMENTS

Allen, T. D. Eyes right and down—not eyes down and right. *Amer. Jour. Ophth.*, 1943, v. 26, Nov., pp. 1209-1210.

Fralick, F. B. The treatment of amblyopia. *Amer. Jour. Ophth.*, 1943, v. 26, Nov., pp. 1195-1197.

Nugent, O. B. The management of strabismus. *Jour. Iowa State Med. Soc.*, 1942, v. 32, Dec., pp. 533-537.

An attempt is made by the author to classify the cases of strabismus according to age of the patients and a system of treatment to be applied to each age group, as follows: (1) In patients from one to six years of age, correction of error of refraction under cyclopegia, daily occlusion of the good eye, attention to avitaminosis, orthoptics; (2) in patients from 7 to 15 years, correction of error of refraction under cyclopegia, occlusion of functioning eye, orthoptics; (3) in patients from 15 to 30 years of age, correction of refraction, orthoptics, surgery, postoperative orthoptics; (4) In patients 30 years of age and beyond, refraction manifest or cyclopegic, surgery. The writer discusses various surgical methods, and describes the technique which he favors, namely, recession with a control suture. A vertical 10-mm. incision is made in the conjunctiva with iris scissors over the point of attachment of the muscle. The muscle is dissected from conjunctiva and Tenon's capsule for about 5 mm., and is then cut loose from the globe with the same iris scissors while it is steadied with a muscle clamp. For control suture a no. 4 doubly-armed silk thread is used, being placed through the muscle tendon in such a manner as to hold the muscle flat against the sclera. The cut edges of the conjunctiva are sutured. The eyes are inspected to determine their relative position, using the corneal reflex from the light of an electric ophthalmoscope; and other surgery is performed on the same or the second eye if necessary. The control suture is then adjusted so as to produce parallelism between the visual axes of the two eyes, using a Maddox rod in front of the

unoperated eye while the patient wears his correcting glasses. A surgeon's knot is made and the loose ends of the control suture are fastened on the patient's forehead. Readjustment is repeated if necessary, and the suture is removed on the fourteenth day. References, 8 illustrations.) M. Lombardo.

Prangen, A. DeH. The relationship of orthoptic treatment to surgery. *Amer. Jour. Ophth.*, 1943, v. 26, Dec., pp. 1298-1302. (References.)

Stark, E. K. Evaluation of orthoptic instruments. *Amer. Jour. Ophth.*, 1943, v. 26, Dec., pp. 1308-1312.

Walraven, Frances. The parents' role in orthoptic training. *Amer. Jour. Ophth.*, 1943, v. 26, Nov., pp. 1175-1179.

## 5

### CONJUNCTIVA

Browning, S. H. Tuberculosis of conjunctiva. *Proc. Royal Soc. Med.*, 1943, v. 36, June, pp. 407-408.

The author presents the case of a 29-year-old female patient who had a hard, punched-out ulcer on the left lower eyelid, sections of which showed giant-cell systems and acid-fast bacilli. Guinea-pig inoculation was positive. In the accompanying discussion, it was brought out that these cases of human-type tubercle of the lids were usually not part of a generalized tuberculosis. The value of ultraviolet and heliotherapy, as well as of sanatorium régime, was also stressed.

Benjamin Milder.

Gallaher, Clinton. A study of trachoma with a report of 318 cases, 233 treated with sulfanilamide. *Jour. Oklahoma State Med. Assoc.*, 1943, v. 36, May, p. 185.

Basing his opinion on the great number of trachoma patients treated with sulfanilamide and observed for an appreciable period, the author believes that although sulfanilamide may not be beneficial in every case of trachoma one can be assured that it will be of great benefit in over 90 percent of the cases. In cases of subepithelial follicles and beginning pannus the treatment consisted of peroral administration of sulfanilamide only. In cases with papillary hypertrophy and advanced pannus, sulfanilamide was given by mouth and the case was observed for three to four weeks, after which grattage was done. This was followed by local administration of one-percent sulfanilamide in Ringer's solution, and at bedtime 0.5-percent zinc ointment was applied. If phlyctenules or acute keratitis complicated the picture, vitamin A (afaxin in oil) was instilled. Sulfanilamide may be given with reasonable safety to ambulatory patients. R. Grunfeld.

Goldenberg, A. Z. Therapy of gonoblennorrhea with albucide. *Viestnik Oft.*, 1943, v. 23, pt. 1, p. 29.

This is a report of a clinical study on the local use of sodium acetyl sulfanilamide in gonoblennorrhea. Because the concentration of sulfanilamides administered by mouth is lower in the conjunctiva than in any other tissue, the author doubts the effectiveness of its oral administration in conjunctival infections; in addition the sulfonamides are quite toxic in infants, who form the majority of patients with gonoblennorrhea. Sodium acetyl sulfanilamide is soluble in water to a 40-percent concentration. A 30-percent solution was tested on the eyes of rabbits in the laboratory; it was instilled every thirty minutes for four hours and found harmless. The pure powder instilled four times at hourly intervals produced

only a slight transitory conjunctival injection, without any corneal changes. Clinically this therapeutic agent was tried in nine cases of gonoblennorrhea. The conclusions are that this preparation in a 10 to 30 percent concentration is very effective in gonoblennorrhea acquired during delivery; that in such cases the conjunctival sac was sterile after 2 to 3 days treatment; and that early corneal infiltrates absorbed promptly, the ulcers becoming clean and covered with epithelium. The local instillation of this drug caused no toxic symptoms.

The drug was less effective in gonoblennorrhea acquired after birth. In some cases the conjunctiva became sterile in a few days, in others it took 10 to 15 days, and in some the deeper layers of the conjunctiva contained involution forms of the gonococcus for as long as 25 days. It appears therefore that while this agent affects the gonococcus profoundly, it produces complete sterilization only after prolonged instillation. The effectiveness of this drug is insignificant in gonoblennorrhea of adults, even in moderately severe cases.

Ray K. Daily.

MacCallan, A. F. Tumor of conjunctiva simulating tubercle due to trachoma. Trans. Ophth. Soc. United Kingdom, 1942, v. 62, pp. 79-82.

A man 32 years of age had a tumor of the conjunctiva of the upper lid, with irregular "hob-nail" surface which was called trachoma. Such an unusual type has been described not infrequently in the Baltic coast region. After the surface growth was treated with beta radiation, the mass disappeared very promptly. (2 illustrations.)

Beulah Cushman.

Schnee, I. M. Membranous inflammation of oropharynx, nose, and con-

junctiva due to sulfathiazole. Brit. Med. Jour., 1943, April 24, p. 506.

Membranous inflammation of the conjunctival, nasal, pharyngeal, buccal, and laryngeal mucosa appeared on the fifth day of sulfathiazole therapy in one-gram doses every four hours, four times daily, for an upper respiratory infection. Cultures for diphtheria were negative. Staphylococci and *M. catarrhalis* were found. Wassermann and urine tests were negative. When first administered, the drug caused deferescence and relief of symptoms, but the fever returned when the complicating membranous changes appeared. On the ninth day of sulfathiazole therapy the drug was discontinued, and in ten days all the lesions had disappeared.

Francis M. Crage.

## 6

### CORNEA AND SCLERA

Ballantyne, A. J. "White rings" in the cornea (G. Coats). Trans. Ophth. Soc. United Kingdom, 1942, v. 62, pp. 83-102.

Macroscopic and microscopic examinations of a "white ring" of the cornea are described. The ring was composed of discrete, closely set, apparently globular, chalky-white bodies measuring 1.5 micra. The bodies were refractile rather than obstructive, and were grouped around a central area. They were somewhat irregular in shape and of waxy appearance, and were situated between the epithelium and Bowman's membrane, the base line of the epithelium extending over the cavities. Chemical analysis indicated some calcium salt. In dealing with etiologic factors the author mentions congenital and traumatic cases and those arising from some antecedent intraocular disease. (12 illustrations, references.)

Beulah Cushman.

Barrenechea, S., Contardo, R. and Arentsen, J. Riboflavin in the treatment of various corneal affections. *Ophth. Ibero Amer.*, 1943, v. 4, no. 4, pp. 405-421 (in Spanish), pp. 421-434 (in English).

The authors discuss the physiologic role of riboflavin and the symptoms of ariboflavinosis, especially as regards the eye. From these considerations, and from treatment of 109 patients, they draw the following conclusions: Vascularization of the cornea is a mechanism of compensation for obtaining the oxygen of hemoglobin when it cannot be furnished by natural riboflavin. The first dose should be high, 3 to 5 mg. given intravenously, dropping afterward to 2 mg. daily for one week. Corneal ulcer sometimes becomes negative to fluorescein within 12 or 14 hours. Failures with riboflavin are attributed to inadequate dosage, lack of intestinal absorption when the preparation is given by mouth, systemic lack of pantothenic acid, excessively severe ariboflavinosis, or active tuberculosis. Parnechymatous keratitis also appeared to be benefited by a riboflavin dosage of 5 or 6 mg. daily.

W. H. Crisp.

Daily, R. K. Familial corneal dystrophy. *Texas State Jour. of Med.*, 1943, v. 39, May, p. 34.

The author records five cases of corneal dystrophy occurring in one family. One pedigree chart and five black and white drawings are included. The corneal dystrophy of the family belonged to the granular type. A short review of the characteristics of the three types of corneal dystrophy is given.

T. M. Shapira.

Gregory, M. K. The ocular criteria of deficiency of riboflavin. *Brit. Med. Jour.*, 1943, July 31, p. 134.

Early ocular signs of riboflavin deficiency are discussed. Corneal vascularization is found to be a more reliable sign than the circumcorneal injection which has lately been given more attention.

In the corneal vascularization, the vessels are arranged streamer-like around the cornea in both eyes. The normal anatomy of this area of the eye is discussed, and other pathologic conditions which might present similar pictures are mentioned.

Gertrude S. Hausmann.

Lazarev, E. G. The absorption of corneal opacities of various etiology. *Viestnik Oft.*, 1943, v. 22, pt. 1, p. 7.

This is a preliminary report on a procedure designed to hasten the absorption of corneal opacities. In his work with corneal transplantation Filatov noticed the beneficial effect of the operation on the cornea of the host; the opaque cornea around the transplant became more transparent. Filatov attributed this phenomenon to the action of substances which develop in the transplanted cadaver-cornea during the period of its conservation on ice. Lazarev noticed the same effect in a case of transplantation of fresh cadaver-cornea. It then occurred to him that perhaps the beneficial effect was due not to the action of the transplanted cornea, but to excision of a segment from the opaque cornea, thus opening a drainage route for deleterious substances accumulated within the cornea. Lazarev believes that in cases of deep keratitis the intact epithelium obstructs the evacuation of exudates accumulated within the cornea, and that the clearing of corneal opacities can be hastened and promoted by excision of a superficial strip of cornea. He finds support for this belief in the fact that corneal diseases with destruction of corneal

epithelium run a more rapid clinical course than corneal diseases in which the corneal epithelium remains intact. With this idea, in seven cases of tuberculous or luetic parenchymatous keratitis he excised a strip of cornea 2 by 4 mm. in size, with visual improvement in all cases. He subsequently modified the procedure. Now, instead of completely excising a flap, it is left attached at its upper border, hanging from the cornea like an apron. (Illustration.)

Ray K. Daily.

Loewenstein, Arnold. **Some contributions to the lipoidal pathology of ocular tissue.** *Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, pp. 159-167.

The author describes two groups of fatty dystrophy of the cornea. The primary is of unknown origin and shows symmetrical bilateral interstitial involvement with no sign of inflammation or vascularization. The secondary follows such diseases as keratomalacia, herpes, scars, dermoids, and degenerative corneal conditions. The collection of fat is due to a disturbance in the local metabolism where the oxidizing power is not sufficient to oxidize the high quantity of blood fat. (8 illustrations.)

Beulah Cushman.

Stone, Simon. **Vitamin E (wheat germ oil) in the treatment of interstitial keratitis.** *Arch. of Ophth.*, 1943, v. 30, Oct., pp. 467-475.

It has been demonstrated that wheat germ oil has a beneficial effect on the absorption of tissue exudates as observed in cases of arthritis deformans, in cases of congenital nonobstructive hydrocephalus, and in selected cases of pseudohypertrophic muscular dystrophy. These observations have led to its use in resistant cases of interstitial keratitis. Ten patients with luetic interstitial

keratitis were treated. All had received ample antisyphilitic therapy and six had received fever therapy. The vitamin therapy consisted in the administration of vitamin-E concentrates combined with vitamin-B complex. All ten of the cases treated, even some with long-standing opacities, showed definite improvement.

This combination of vitamin E with B complex hastens the absorption of corneal exudates and opacities. It also prevents further organization of scar tissues of the cornea and reduces excessive capillary permeability. Riboflavine is thought to enhance the action of vitamin E by its beneficial effect on the oxidative processes of the cornea.

It is suggested that, in addition to antisyphilitic therapy, all patients with interstitial keratitis be given a mixture of vitamin E with B complex. Artificial fever is of value in preventing relapses and in producing a more rapid subsidence of acute symptoms.

John C. Long.

Sugar, H. S. **A new material for anterior-segment impressions.** *Amer. Jour. Ophth.*, 1943, v. 26, Nov., pp. 1210-11.

Vail, D., and Ascher, K. W. **Corneal-vascularization problems.** *Amer. Jour. Ophth.*, 1943, v. 26, Oct., pp. 1025-1044; also *Trans. Amer. Ophth. Soc.*, 1942, v. 40, p. 181. (21 figures, references.)

Wetzel, J. O. **Groenouw's corneal dystrophy.** *Amer. Jour. Ophth.*, 1943, v. 26, Nov., pp. 1183-1194. (6 figures, 1 chart, bibliography.)

Zavalía, J. M., and Amado, C. F. **Bilateral iridocyclitis and band opacity of the cornea in Still's disease.** *Anales Argentinos de Oft.*, 1942, v. 3, Oct.-Nov.-Dec., p. 189. (See Section 7, Uveal

tract, sympathetic disease, and aqueous humor.)

## 7

# UVEAL TRACT, SYMPATHETIC DISEASE AND AQUEOUS HUMOR

Meyer, G. P. Syphilis in relation to the iris and uveal tract. *Jour. Med. Soc. New Jersey*, 1943, v. 40, Feb., p. 55.

The author presented this paper as a part of a symposium on syphilis and its relation to eye, ear, nose, and throat. He discusses the incidence of syphilis, roseola of the iris, secondary and tertiary and recurrent syphilitic iridocyclitis, congenital syphilis of the uvea, and diagnosis and prognosis of uveal syphilis. Interesting is a quotation by the author from Weiss, who states that 55 percent of all iritis is luetic.

T. M. Shapira.

Rabinowicz, M. G. Blood changes in threatened sympathetic ophthalmia. *Viestnik Oft.*, 1943, v. 25, pt. 1, p. 20.

In spite of the war and industrialization, the frequency of sympathetic ophthalmia following perforating injuries was reduced from 2.90 percent in 1900 to 1918 to 1.72 percent in 1919 to 1935. This is to be attributed to improved prophylaxis, that is, insistence on enucleation of the injured eye in threatened sympathetic ophthalmia. Because of the large number of perforating ocular injuries during the war the diagnosis of threatened sympathetic ophthalmia becomes very important. To point out the difficulty of diagnosis Rabinowicz cites the fact that of 914 eyes enucleated in 1926 to 1934 with the diagnosis of sympathetic ophthalmia, only in 25 was the diagnosis confirmed microscopically. The author reviews the literature on the efforts to find assistance for the diagnosis in the blood mor-

phology, and gives a condensed report of his own studies on 120 patients with severe perforating ocular injuries and severe clinical symptoms of iridocyclitis, acute or chronic. Blood studies, where possible, were made on the day the injury was received, and every other day after that. The data confirm the published findings that monocytosis, when it occurs, does not appear before the eighth or ninth day. Of the 120 case histories 48 contain a histopathologic report; in 72 this was not available. Of eight cases, confirmed histologically as threatened sympathetic ophthalmia, in six there was a high monocytosis, in one a moderate monocytosis, and in one a slight lymphocytosis without monocytosis. The monocytosis found in the seven cases receded very slowly after enucleation. In two cases, one clinically severe and one moderately severe, in which the histologic diagnosis between infiltrating uveitis and endophthalmitis could not be made, there was moderate monocytosis, slowly receding after enucleation. The author believes that the blood morphology of these ten cases supports the already demonstrated relation between monocytosis and sympathetic ophthalmia. In 15 cases with histologically confirmed endophthalmitis, monocytosis was absent. In 17 cases of uveitis, histologically lacking the characteristics of sympathetic ophthalmia, there was high monocytosis in five cases, moderate in six, and none in six. The degree of monocytosis ran parallel with the severity of the clinical symptoms. Of the 72 clinical case histories without histologic data, in 68 there was complete correlation between the monocytosis and the severity of the clinical symptoms. The author believes that the blood picture is a very sensitive indi-

cator of infection, and that monocytosis develops prior to demonstrable histologic processes. The slow recession of the monocytosis after enucleation shows that the infection remains in the blood for some time, and explains the occurrence of sympathetic ophthalmia several weeks after enucleation of the injured eye. Ray K. Daily.

Zavalia, J. M., and Amado, C. F. Bilateral iridocyclitis and band opacity of the cornea in Still's disease. *Anales Argentinos de Oft.*, 1942, v. 3, Oct.-Nov.-Dec., p. 189.

Still's disease is a form of rheumatism or arthritis, resulting from a chronic infectious process caused by the streptococcus viridans. The portal of entry is the throat, teeth, or sinuses. The ailment occurs principally in children, although an adult form has been described. The case now reported is that of a boy of ten years in whom the disease had appeared at the age of one year, as small painless cysts of the wrist and knees, with progressive enlargement. The child was poorly developed and showed polyglandular swellings and marked deformities of the extremities. Each eye presented a transverse film of the cornea, scleral staphyloma, and chronic iridocyclitis. A blood culture showed a gram-positive streptococcus. The literature is reviewed and discussed. (4 figures.)

Eugene M. Blake.

## 8

### GLAUCOMA AND OCULAR TENSION

Alexander, G. F. Depletion of the vitreous in glaucoma. *Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, pp. 153-157.

The author describes a decompression operation on the sclera, with drain-

age of the vitreous, in eyes blind from old injuries or chronic glaucoma.

Beulah Cushman.

Marshal, J. C. A case of chronic glaucoma complicated by detachment of the retina. *Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, pp. 149-151. (See Section 10, Retina and vitreous.)

Martin, J. E. Atropine glaucoma. *Brit. Med. Jour.*, 1943, May 22, p. 631.

Old age is no contraindication to the use of atropine. When full mydriasis and cycloplegia are required we should use the drug boldly by the subconjunctival route. But efficient drainage of the aqueous must always be proved beforehand.

R. Grunfeld.

Schoenberg, M. J. Is glaucoma a deficiency disease? Important details concerning the nonsurgical treatment of glaucoma simplex. *Amer. Jour. Ophth.*, 1943, v. 26, Dec., pp. 1282-1288. (4 illustrations.)

## 9

### CRYSTALLINE LENS

Carleton, Alice. Skin disease and cataract. *Brit. Jour. Derm. and Syph.*, 1943, v. 55, April, p. 83.

The skin diseases in which juvenile cataract may occur are allergic eczema, poikiloderma, and scleroderma.

Cases of allergic eczema in association with cataract are briefly reviewed. In the discussion of the investigation of others, the author brings out the fact that in allergic eczema no specific allergen has ever been proved. A case of familial telangiectasia and cataract with myotonic dystrophy is described. These skin diseases are said to be genetically inherited, though the type of genetic inheritance is different in each.

Francis M. Crage.



Guyton, J. S., and Woods, A. C. Oral use of prophylactic sulfadiazine for cataract extractions. *Amer. Jour. Ophth.*, 1943, v. 26, Dec., pp. 1278-1282.

Neblett, H. C. Choroidal detachment following cataract extraction. *Southern Med. and Surg.*, 1943, v. 105, May, p. 225.

Choroidal detachment occurs in 4 percent of the cases after cataract extraction. That it is not observed more often is attributable to the fact that many surgeons do not examine the fundus in the first eight to ten days after the operation and the detachment becomes reattached within ten days without any visible evidence of its former presence. The detachment is produced by injury of the ligamentum pectinatum during the operation, allowing aqueous humor to filter into the space below the choroid. Or it may be caused by the rupture of a choroidal vessel.

Subjectively the patient will complain of a dull, heavy feeling in the eye. Objectively a hemorrhage in the anterior chamber may be found. The wound margins are swollen, the anterior chamber is shallow, the globe is soft to palpation. Ophthalmoscopic examination will reveal a smooth, round, nonfluctuating, brownish-gray mass protruding into the vitreous and arising from either the nasal or the temporal half of the fundus.

One case history is given. A 55-year-old man had been operated upon for cataract. The operation and the post-operative course were uneventful until the eighth day, when the detachment of the choroid was noted. The choroid became reattached after the twelfth day. A few scattered areas of pigmentation in the retina were noted at the

site of the previously detached choroid.  
R. Grunfeld.

Shah, M. A. Cataract in untreated cases of diabetes mellitus. *Indian Med. Gazette*, 1943, v. 78, Feb. p. 71.

The author reports 36 cases of cataract in untreated cases of diabetes mellitus. The diabetes was mostly of the moderately severe type and the cataracts of the senile cortical variety. The incidence of cataract increased with the age of the patient, and the duration of the cataract varied from one to 12 years.  
R. Grunfeld.

Wolfe, O. R., Wolfe, R. M., and Georgariou, P. Discussion of congenital (cataractous) dislocated lens. *Amer. Jour. Ophth.*, 1943, v. 26, Dec., pp. 1313-1314.

## 10

### RETINA AND VITREOUS

Craik, K. J. W. Specifications for dark-adaptation tests. *Brit. Med. Jour.*, 1943, May 22, p. 632.

To use the dark-adaptation tests intelligently and to enable one to compare the findings of different observers, standardization is necessary. That is, agreement must be reached as to size of field, form or figure used in the test, quality of light, duration of exposure, retinal area to be tested and so on. Moreover, there is an equal need of calibration, or of exact measurement of the physical properties of the instrument, to enable one to produce an exact copy of the instrument.

R. Grunfeld.

Ebert, R. H. Angioid streaks and pseudoxanthoma elasticum. *Arch. Derm. and Syph.*, 1943, v. 48, July, pp. 75-82.

Ebert describes angioid streaks, ophthalmoscopically, as jagged, irregular streaks, in some cases radiating in spokelike fashion from the region of the discs, in others anastomosing and intersecting. Angioid streaks were associated with serious pathological alterations of the macula in 140 of 188 cases, as covered by one review. The differential diagnosis is discussed briefly by Ebert. Pseudoxanthoma elasticum is characterized by yellow plaques, occurring especially in the skin folds. It is symptomless. Pathologically, there is destruction of elastic fibers in the skin. The degenerated elastic fibers are rich in calcium.

The cause of each of these diseases is unknown, but both are rare, and they are too frequently associated for the experience to be coincidental. Ebert stresses the points of similarity, and cites statistics correlating the two conditions. The pathology of angioid streaks is uncertain, the evidence conflicting. Verhoeff found folds in Bruch's membrane and the choriocapillaris, but the remaining eye showed no angioid streaks; Law found a similar appearance of folds, but did so in an eye sectioned after being in fixatives several months. In Benedict's case, no retinal pathology was found. Bock and Hagedoorn observed cases showing in Bruch's membrane atrophic changes which by serial reconstruction resembled angioid streaks seen ophthalmoscopically. Apparently the two diseases are related instances of disease of the elastic tissue, but their exact nature has not yet been determined.

Benjamin Milder.

Huggett, A. S., and Juler, F. A. Heparin in thrombosis of the central vein of the retina. *Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, pp. 123-134.

The use of heparin in the treatment of seven cases of retinal thrombosis is described by the author. Constitutional reactions occurred in six cases. They consisted of pyrexial attacks which did not recur upon reduction of the next dose. In some cases hemorrhages occurred in arm, leg, or finger in connection with the punctures used for intravenous administration or in collection of blood from other parts of the body for estimation of the coagulation time.

An increase in the retinal hemorrhage of the affected eye was noted in five cases, and small retinal hemorrhages in the unaffected eye in one case. One patient had slight epistaxis.

The authors conclude that it is impossible to attribute any benefit to this drug, and that its administration is not without danger. (One table, references.)  
Beulah Cushman.

McLane, J. N. Retinal hemorrhage in a case of rattlesnake bite. *Jour. Florida Med. Assoc.*, 1943, v. 30, July, p. 22. (See Section 16, Injuries.)

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A patient with a separated retina was found to have complete cupping of the disc when the nerve became visible after the operative interference. The tension had been normal at all times during preliminary observation. Two other cases of glaucoma with separated retina are reported.

Beulah Cushman.

Mattos, W. B. (with "V.J."). Self-observation of retinal detachment. *Arquivos Brasileiros de Oft.*, 1943, v. 6, June, pp. 63-67.

See editorial, this issue, page 189.

Guyton, J. S., and Woods, A. C. Oral use of prophylactic sulfadiazine for cataract extractions. *Amer. Jour. Ophth.*, 1943, v. 26, Dec., pp. 1278-1282.

Neblett, H. C. Choroidal detachment following cataract extraction. *Southern Med. and Surg.*, 1943, v. 105, May, p. 225.

Choroidal detachment occurs in 4 percent of the cases after cataract extraction. That it is not observed more often is attributable to the fact that many surgeons do not examine the fundus in the first eight to ten days after the operation and the detachment becomes reattached within ten days without any visible evidence of its former presence. The detachment is produced by injury of the ligamentum pectinatum during the operation, allowing aqueous humor to filter into the space below the choroid. Or it may be caused by the rupture of a choroidal vessel.

Subjectively the patient will complain of a dull, heavy feeling in the eye. Objectively a hemorrhage in the anterior chamber may be found. The wound margins are swollen, the anterior chamber is shallow, the globe is soft to palpation. Ophthalmoscopic examination will reveal a smooth, round, nonfluctuating, brownish-gray mass protruding into the vitreous and arising from either the nasal or the temporal half of the fundus.

One case history is given. A 55-year-old man had been operated upon for cataract. The operation and the post-operative course were uneventful until the eighth day, when the detachment of the choroid was noted. The choroid became reattached after the twelfth day. A few scattered areas of pigmentation in the retina were noted at the

site of the previously detached choroid.  
R. Grunfeld.

Shah, M. A. Cataract in untreated cases of diabetes mellitus. *Indian Med. Gazette*, 1943, v. 78, Feb. p. 71.

The author reports 36 cases of cataract in untreated cases of diabetes mellitus. The diabetes was mostly of the moderately severe type and the cataracts of the senile cortical variety. The incidence of cataract increased with the age of the patient, and the duration of the cataract varied from one to 12 years.  
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Mattos, W. B. (with "V.J."). Self-observation of retinal detachment. *Arquivos Brasileiros de Oft.*, 1943, v. 6, June, pp. 63-67.

See editorial, this issue, page 189.

Riddell, W. J. B. On testing dark adaptation. *Glasgow Med. Jour.*, 1943, v. 21, June, pp. 149-157.

The author describes his modification of the Birch-Hirschfeld adaptometer, so arranged that a relatively constant portion of the retina is tested, in an area where there is an approximately equal distribution of rods and cones. The paper is essentially a series of generalizations concerning the testing of dark adaptation. The author describes the wide range of light intensities covered, necessitating the logarithm unit for plotting the curves of dark adaptation. The varying sensitivity of rods and cones to light of different wave-lengths is discussed, as well as the variations in the cone-rod transition-time produced by varying the preliminary light-adaptation period. The paper stresses the importance of studying the entire curve of dark adaptation, rather than just the final rod-threshold, in correlating nutritional studies with organic disease such as hepatic cirrhosis. Benjamin Milder.

Wolff, Eugene. *Retinitis proliferans*. *Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, pp. 115-122.

The author discusses the fate of the blood after a vitreous hemorrhage. He describes a microscopic specimen in which the fluid remained and tended to form a blood cyst. The membranous wall (*retinitis proliferans*) was traced over the internal limiting membrane of the retina. It suggested separated vitreous and contained blood elements. (3 illustrations, references.)

Beulah Cushman.

Yudkin, J., and Ferguson, A. A critique of the Bishop Harman test for night vision. *Brit. Med. Jour.*, 1943, May 22, p. 632.

The authors critically analyze Harman's new apparatus for measuring night vision. The apparatus consists of groups of white discs mounted on a black background and illuminated by a standard candle five meters away. After 15 minutes of dark adaptation the subject is required to stand at such a distance that he is just able to distinguish the discs and count them. A shorter distance indicates poorer, a greater distance, better night vision.

The analysis reveals that the instrument is faulty in many respects on theoretical consideration. It proved also to be unsatisfactory on practical application. The dark adaptation of thirty subjects was examined with this apparatus and compared with the results obtained on the Haines instrument. The results obtained by the two instruments showed but little correlation. R. Grunfeld.

Yudkin, J., Robertson, G. W., and Yudkin, S. Vitamin A and dark adaptation. *Lancet*, 1943, v. 245, July, pp. 10-13.

Using an instrument modified from the Crookes adaptometer, the authors measured the complete course of dark adaptation in four hundred subjects. By their technique, after light-adapting the subject, the retinal threshold was measured repeatedly over a period of forty minutes. Their graphs show, typically, an initial rapid adaptation (the "cone threshold") followed by a slower adaptation (the "rod threshold"). The authors stress the importance of evaluating dark adaptation in terms of the entire function—that is, the cone threshold, the rod threshold, the transition time between these two phases, and the final rod-threshold level. They believe that the adaptometers which measure the visual threshold at one

particular time are misleading, and in many cases erroneous. If one single criterion is to be selected, it should be the final rod-threshold.

The authors made an intensive study of the influence of altered vitamin-A intake (marked increases and decreases) on the dark adaptation of a series of normal individuals, and found that alterations in any of the phases of the dark adaptation curve were possible, but the most constant changes were in the final rod-threshold—the condition approaching complete dark-adaptation.

Benjamin Milder.

## 11

### OPTIC NERVE AND TOXIC AMBLYOPIAS

Doggart, J. H. On diagnosing papilledema. *Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, pp. 141-144.

The author mentions the following objective signs of papilledema as of value in forming an opinion as to the significance of swelling of the disc during the early stages: (1) slight parallax movement, (2) the impression of a slight forward thrust of the disc (one diopter or more), (3) turgidity of veins, (4) alteration in the light reflex of vessels crossing the edges of the disc, (5) hemorrhages, (6) partial or total obliteration of the physiologic cup, (7) enlargement of the blind-spot, (8) blurring of the disc edges.

Beulah Cushman.

Leinfelder, P. J. Choked discs and low intrathecal pressure occurring in brain tumor. *Amer. Jour. Ophth.*, 1943, v. 26, Dec., pp. 1294-1298; also *Trans. Amer. Ophth. Soc.*, 1943, v. 41. (One table, references.)

Nceme, Humphrey. Congenital hole in the optic disc, with a scotoma.

*Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, p. 137.

The author reports the case of a patient who had a hole in the optic disc. The lower half of the visual field was lost up to the area of fixation. The tension was normal and there was no pathologic cupping of the disc. One other patient with a hole in the disc had no visual-field changes.

Beulah Cushman.

Voss, O. Neurolysis of the optic nerve. *Zentralblatt für Chirurgie*, 1942, v. 69, April, pp. 595-601.

A woman of 47 years sustained a severe fracture of the base of the skull in an automobile accident. The right eye had to be enucleated. After convalescence was completed, gradual deterioration of the visual acuity of the remaining eye was noticed. There was temporal hemianopsia, but central vision was fairly good. Other neurological findings were normal.

Operation was performed under local anesthesia after preliminary luminal. Dandy's technique was used, the skin flap being reflected forward and the bone flap toward the temporal region. The opening of the bone flap was attended by considerable difficulty, the dura being quite generally adherent to the bone. The surface of the brain showed a marked arachnoiditis, particularly in the frontal pole and along the superior sagittal sinus. After various anatomic preliminaries, there was found an unmistakable arachnoiditis of the cisterna of the chiasm. The left optic nerve was wrapped in scar tissue of appreciable thickness, contraction of which was unmistakably causing pressure upon the nerve. There was apparently no pathologic condition of the bone in the region of the optic foramen, particularly in the form of an exostosis,

and the nerve appeared normal outside of the scarred area. All the adhesions were separated with a hook, leaving the nerve entirely free. The scar tissue which had surrounded the nerve was split and partly removed, as also were the arachnoidal adhesions in the vicinity. There were similar conditions on the right side, but no resection was undertaken here, because of the absence of the right eye. Several weeks later the patient showed no further advance in visual disturbance. The visual field had undergone no further change. The patient returned to her work as librarian.

In the second patient, a soldier who had been injured by a grenade from which several splinters were lodged in the anterior cranial fossa, the technique of operation was similar to that in the first patient. In attempting to approach the chiasm, the anterior pole and the floor of the right frontal lobe were found extensively adherent to the dura. Parts of the frontal pole were resected, the frontal lobe freed from the floor of the anterior fossa, and the right optic nerve gradually exposed. There was a good deal of scar formation, the optic nerve itself being surrounded by a circular callous. The latter was split in the direction of the nerve fibers. It was then found that peripherally from the chiasm the right nerve had been torn half way through on its medial side by a rather small irregular grenade splinter which was still in place. The circular mass of scar tissue was excised as accurately as possible, and arachnoidal adhesions in the angle of the chiasm were also divided. The left nerve was macroscopically normal. Postoperative convalescence was complicated by necessity for repeated puncture to get rid of accumulations of fluid beneath the skin flaps, and also by a mild meningeal infection.

But the visual disturbances went no further and the patient's general condition was considerably improved, with disappearance of severe headache which had existed before the operation.

The author suggests that the optic nerve has a materially greater capacity for regeneration than an ordinary spinal nerve. (3 illustrations.)

W. H. Crisp.

## 12

### VISUAL TRACTS AND CENTERS

Goldstein, Kurt. Some remarks on Russel Brain's article concerning visual object-agnosia. *Jour. Nerv. and Ment. Dis.*, 1943, v. 98, Aug., p. 148.

The author disputes Brain's assumption that the disturbance of recognition in the case of visual agnosia, which the author has described, was due to impairment of perception and specifically to a defect of the visual field, for the visual field in this case was almost normal. The patient's defect can be understood only as an impairment in the perceptual sphere concerning the degree of form perception, and it warrants a special name, that of visual agnosia.

R. Grunfeld.

Mahoney, V. P., and Linhart, W. O. *Amblyopia in hysteria*. *War Medicine*, 1943, v. 3, May, p. 503.

The authors report 13 cases of hysterical amblyopia. Laboratory work-up psychobiologic studies and ocular examinations including form and red fields, were made on these patients. Concentrically contracted fields and characteristic disturbances of personality were found. Acute, chronic, and mixed types were noted. The authors remind us that hysterical amblyopia occurs in psychobiologically underdeveloped persons and is akin to an acute



hysteric reaction. These cases should be referred to a psychiatrist.

Francis M. Crage.

### 13

#### EYEBALL AND ORBIT

Harley, R. D. *Exophthalmos in the newborn*. *Amer. Jour. Ophth.*, 1943, v. 26, Dec., pp. 1314-1315.

Reese, A. B., and Khorazo, D. *Endophthalmitis due to B. subtilis following injury*. *Amer. Jour. Ophth.*, 1943, v. 26, Dec., pp. 1251-1253. (References.)

Sudakevich, D. I. *Orbital prosthesis for the sequelae of war injuries*. *Viestnik Oft.*, 1943, v. 23, pt. 1, p. 25. (See Section 16, Injuries.)

Sunder-Plassmann, P. *Malignant exophthalmos*. *Zentralblatt für Chirurgie*, 1942, v. 69, Jan. 17, pp. 88-92.

The author's introduction includes mention of a clinical case in which perforation of the corneas rendered bilateral enucleation necessary. The patient whose case report occupies most of the article was a woman of 55 years who, after an accident in which she was in fear of death, developed malignant exophthalmos which failed to yield to prolonged treatment with various forms of medication, as well as by excision of conjunctiva and the use of X rays to the hypophysis. The eye surgeon stated that both eyes were in immediate danger of spontaneous perforation.

Radical operation was therefore undertaken in accordance with Naffziger's technique. The patient was trephined on each side, with formation of bone flaps carrying the temporal muscles. The ventricles were punctured, the basal dura pushed aside, and the

frontal lobes drawn backward. Both orbits were completely decompressed, and the orbital fascia was opened and the individual eye muscles exposed, with avoidance of the frontal branch of the trigeminal nerve. The levator palpebrae, the superior rectus, the internal rectus, and the lateral rectus were found tremendously enlarged, to about the thickness of a thumb. They were firmly adherent to one another, and had to be separated with a fine scalpel. The roof of the optic-nerve canal on each side was decompressed almost as far back as the hypophysis. There was severe edema of the optic nerve on each side, but no change in the orbital fat. At the close of the operation the dura and frontal lobe rested directly on the eyeballs. The patient made a fine recovery, although in the first two days she had a periphlebitis of the leg. There was no longer necessity for the morphine under which it had been necessary to keep the patient before the operation. The exophthalmos rapidly receded. Three months after the operation there was perfect closure of the eyes, and the corneal ulcers had long since healed. The eye clinic reported "normal visual acuity" and good motility of the eyeballs. A year after the operation the patient had gained 35 pounds, and was carrying on all her activities upon a farm. The author states this to be, so far as he knows, the first case of extreme malignant exophthalmos to be operated upon bilaterally in Germany with successful result. (5 illustrations.) W. H. Crisp.

Tucker, John. *Hand-Schüller-Christian disease (idiopathic xanthomatosis)*. *Cleveland Clinic Quarterly*, 1943, v. 10, July, p. 55.

Hand-Schüller-Christian disease occurs most frequently in children under

two years of age. The principal manifestations of the syndrome are osseous xanthoma (producing defects in the membranous bones of the skull), exophthalmos, and diabetes insipidus.

A case of Hand-Schüller-Christian syndrome is reported. X-ray treatment caused extensive healing of the bony defects of the skull. The use of pitresin tannate simplified the treatment of the diabetes insipidus. (6 illustrations.)

Gertrude S. Hausmann.

#### 14

#### EYELIDS AND LACRIMAL APPARATUS

Costa, O. G. Microsporon infection of the palpebral and ciliary regions. *Arch. Derm. and Syph.*, 1943, v. 48, July, pp. 65-69.

Costa reports a case of tinea due to *Microsporon felineum*, in a negro boy. The lesions occurred on the scalp, ears, eyelids, and lashes, producing on the latter a patchy pseudoalopecia and some trichiasis. The diagnosis was supported by culture, mycologic examination and trichophytin test. The infection is usually transmitted by cats and dogs. (3 photographs.)

Benjamin Milder.

Seemen, Hans. A rare disfigurement from scalping—result of new type of restorative operation. *Zentralblatt für Chirurgie*, 1942, v. 69, Aug., pp. 1280-1287.

The hair of a 15-year-old girl was caught in a drive belt, with complete

scalping accompanied by shock, and followed by fever, purulent secretions from the wound, and bad general condition. There was complete loss of the hairy scalp with the exception of slight remains just behind the attachments of the auricles. The right external ear had also been torn off and the defect scarred. Except over the root of the nose, the whole skin of the frontal area had been destroyed, including eyebrows and upper lids, with secondary bilateral ectropion. The outer halves of the lower lids were drawn upward, so that the palpebral fissure on each side was strikingly oblique. In normal position of the head, the lower half of the eyeball was covered by the lower lid, the upper margin of the lower lid bisecting the iris and pupil. The ectropion of the upper lids was so great that the eyelashes were turned directly backward. The eyelids could not be completely closed. The surgical procedures included steps for replacement of the scarred frontal skin with sound skin and reconstruction of the eyebrows. The transplanted skin was obtained from the side of the neck and the upper part of the chest. For the eyebrows, advantage was taken of the small remains of the hairy scalp, with special care to have the direction of the hair run from medial to lateral. Complete restoration of lid function was obtained, and the primarily existing "mongolian" facies was fully overcome. (14 illustrations.)

W. H. Crisp.

# NEWS ITEMS

Edited by DR. DONALD J. LYLE  
904 Carew Tower, Cincinnati

News items should reach the editor by the twelfth of the month

## DEATHS

Dr. Ned A. Balding, Lincoln, Illinois, died October 6, 1943, aged 57 years.

Dr. Thomas V. Connolly, Paterson, New Jersey, died October 21, 1943, aged 53 years.

Dr. Vance M. Cox, Bristol, Virginia, died October 15, 1943, aged 63 years.

Dr. Zenas H. Ellis, New York, New York, died October 20, 1943, aged 48 years.

Dr. George F. Fiske, Chicago, Illinois, died October 18, 1943, aged 83 years.

Dr. Stephen A. Hemmi, Chicago, Illinois, died October 27, 1943, aged 85 years.

Dr. George F. Scheib, Champaign, Illinois, died November 2, 1943, aged 76 years.

Dr. Oscar O. Larsen, Detroit Lakes, Minnesota, died November 7, 1943, aged 66 years.

Dr. Douglas A. Payne, Chicago, Illinois, died November 24, 1943, aged 86 years.

## MISCELLANEOUS

Dr. William H. Crisp, Consulting Editor and Head of the Abstract Department of the American Journal of Ophthalmology, is anxious to learn whether any ophthalmologist in this country is familiar with the Turkish language. The first issue of a new Turkish eye journal has just been received. Please communicate with Dr. Crisp, 530 Metropolitan Building, Denver, Colorado.

The executive office of the American Board of Ophthalmology has been moved to P.O. Box 1940, Portland 2, Maine. Officers for 1944 are the following: Dr. John Green, Saint Louis, chairman; Dr. Frederick C. Cordes, San Francisco, vice-chairman; Dr. S. Judd Beach, Portland, secretary-treasurer; and Dr. Theodore L. Terry, Boston, assistant secretary. The 1944 examinations will be held in New York, on June 3d and 4th; and in Chicago, on October 5th to 7th.

Announcement is made that the Directory of Medical Specialists is now to be published by the A. N. Marquis Company of Chicago, publishers of "Who's who in America." Previous editions have been published for the Advisory Board for Medical Specialties by the Columbia University Press of New York City.

It is planned not to issue the next edition before 1945, on account of the war, but the

A. N. Marquis Company will publish a supplemental list of all those who have been certified by the American Boards since the last (1942) edition of the Directory, totaling about 3,600. This is to be distributed at cost, and monthly or bimonthly bulletins listing successful candidates for certification at examinations during the additional interim before the next edition, are to be issued as a subscribers' service.

Dr. Paul Titus (Pittsburgh) of the American Board of Obstetrics and Gynecology will continue as the Directing Editor, and Dr. J. Stewart Rodman (Philadelphia) of the American Board of Surgery continues as Associate Editor. The Editorial Board will be composed, as before, of the secretaries of the 15 American Boards.

Communications should be addressed to the Directing Editor, Directory of Medical Specialists, 919 North Michigan Avenue, Chicago 11, Illinois.

## SOCIETIES

The Washington, D.C., Ophthalmological Society held its regular meeting on January 10th. The guest speaker was Dr. Maynard C. Wheeler, New York City, who spoke on "Surgical treatment of vertical deviations." The following cases were presented: "Melanoma of the choroid" by Dr. Sterling Bockoven, "Parinaud's oculoglandular syndrome" by Dr. Frank D. Costenbader, and "An unusual case of hyalitis" by Dr. C. Robert Naples.

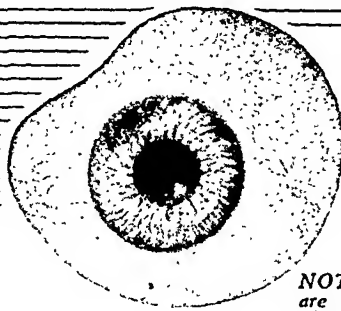
The Research Study Club of Los Angeles held its thirteenth annual postgraduate clinical conference in ophthalmology and otolaryngology January 17th to the 29th. Among the guest speakers were Dr. James Watson White of New York and Dr. Georgiana M. Dvorak-Theobald of Oak Park, Illinois.

A meeting of the Association for Research in Ophthalmology will be held on Tuesday, June 13, 1944, at the Hotel Sherman, Chicago. Applications for places on the program are being received and all communications should be mailed to the secretary, Major Brittain Payne, School of Aviation Medicine, Randolph Field, Texas.

## PERSONALS

Dr. Erich Pressburger announces the removal of his offices to Suite 1436, 450 Sutter Building, San Francisco 8, California.

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## PIGMENT FRECKLES OF THE IRIS (BENIGN MELANOMAS): THEIR SIGNIFICANCE IN RELATION TO MALIGNANT MELANOMA OF THE UVEA\*

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The presence of freckles on the anterior surface of the iris is common. Out of 300 adult patients with supposedly normal eyes, they were noted on one or both irides in 145, or 48 percent. In 93, or 31 percent of these, the freckles were on both irides (about equal in 82, greater on one iris than on the other in 11) and unilateral in 52 or 17 percent. These statistics are based on adult eyes as these pigment freckles do not appear before the age of 6 to 8 years and rarely before 12 years. This is in keeping with the occurrence of pigmented nevi of the skin, which also appear at this age. Although the term "freckles" seems convenient to employ clinically, these iris lesions really represent multiple benign melanomas.

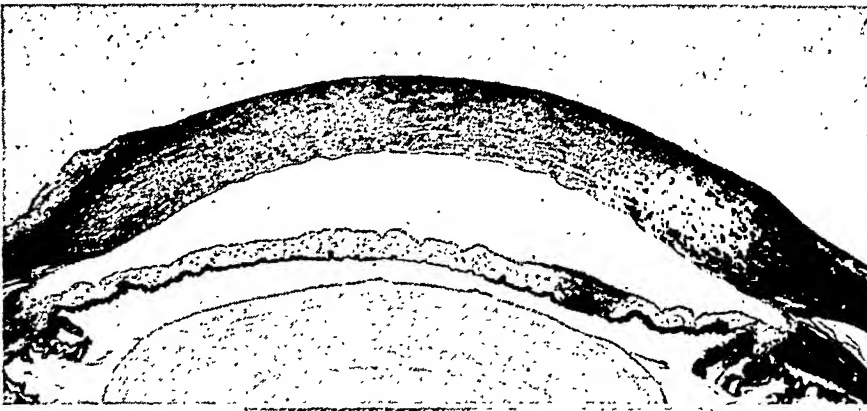
The author has noted the more frequent occurrence of benign melanomas of the iris in the microscopic sections of eyes harboring malignant melanomas of the uveal tract. These have been observed in 13 eyes in which the malignant melanoma was present in the choroid and in 6 eyes in which it was present in the iris or ciliary body.

The histologic difference between the melanomas of the iris seen in normal

eyes and those seen in eyes with malignant melanoma seems to be one of degree. In the case of the normal eye the lesion is a localized accumulation of densely pigmented melanoblasts only a few cells thick along the anterior surface of the iris. In fact, the lesion could be characterized as merely a localized thickening of the anterior limiting layer of the iris which, in some instances, has the appearance of being proliferated endothelium. Such a lesion may sometimes contain little or no pigment.

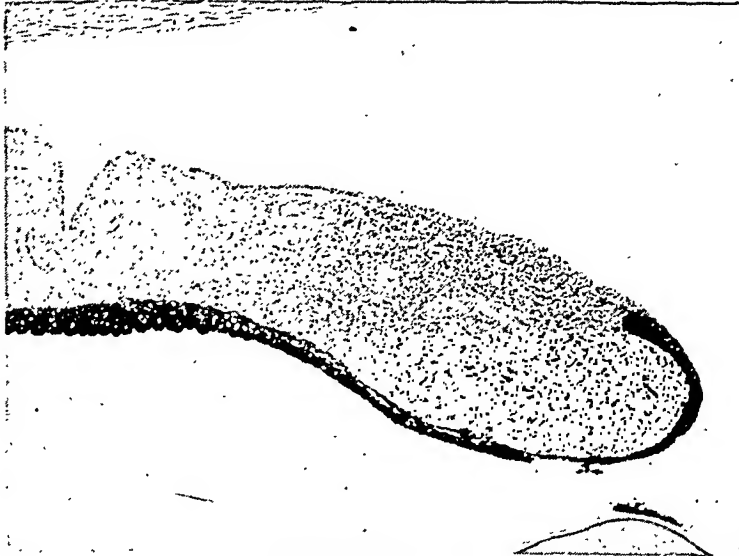
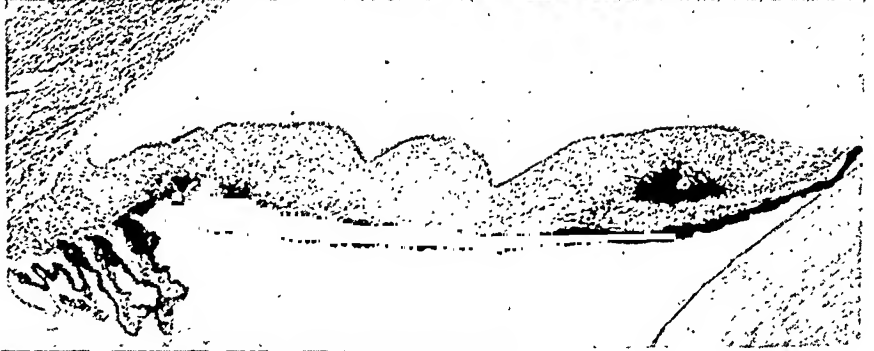
The melanomas of the iris in eyes with malignant melanoma are more extensive lesions (fig. 1 a, b, c, d). They tend to be slightly more elevated above the iris surface and to extend deeper into the iris stroma. Sometimes they actually arise in the stroma (fig. 1 b) and may even cause an increase in the thickness of the iris. In one instance an ectropion uvea was produced (fig. 1 c). The type cell is the melanoblast, varying in shape from plump polygonal to long, branching, pigmented cells. When the cells spread through the entire thickness of the iris, they seem to have a predilection to abut on the dilator-muscle layer in a manner that steel fragments display toward a magnet. The cells are more matured than those of the malignant melanoma but sometimes less matured than those comprising the physiologic melanomas of the

\* From the Institute of Ophthalmology of the Presbyterian Hospital. Read at the seventy-ninth annual meeting of the American Ophthalmological Society, Hot Springs, Virginia, June 11, 1943.



1 a, A benign melanoma of the iris extending through the entire thickness of the stroma.

1 b, A benign melanoma of the iris arising in the iris stroma.



1 c, A benign melanoma of the iris occupying the entire pupillary area, increasing the thickness of the stroma and causing an ectropion of the uvea (from the collection of Dr. Georgiana Theobald).

1 d, A benign melanoma of the iris occupying the pupillary area. The cells composing this resemble more closely the cells of the malignant melanoma of the choroid than in cases "a," "b," and "c."

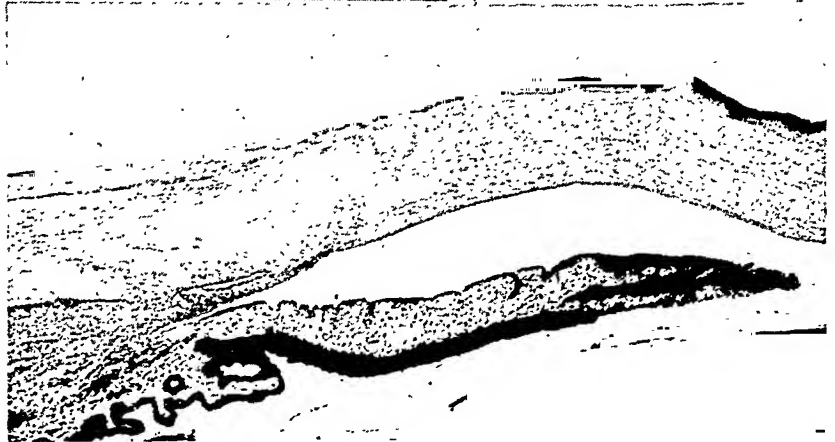


Fig. 1 (Reese). Four illustrations of benign melanoma of the iris in eyes with malignant melanoma of the choroid.

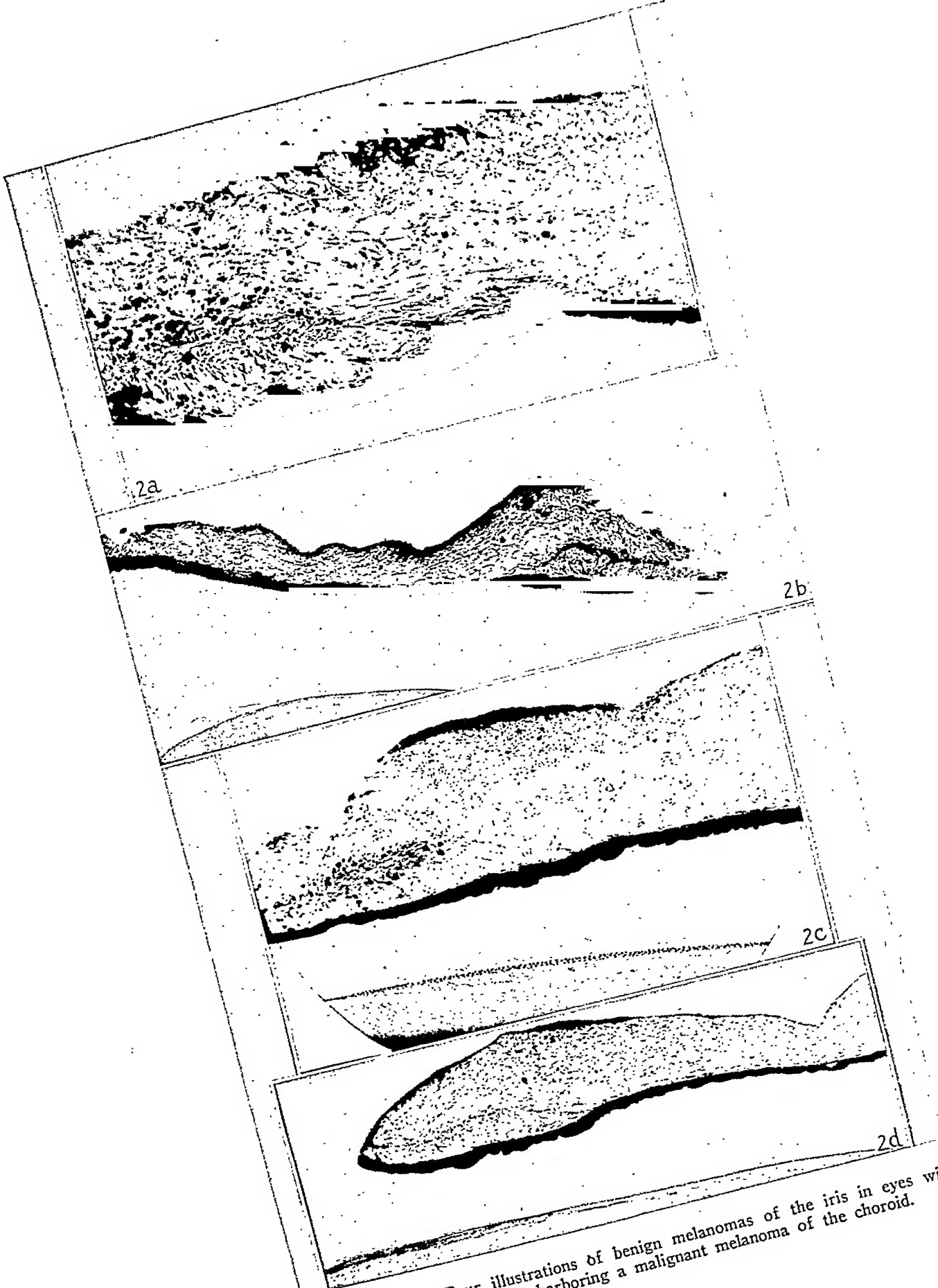


Fig. 2 (Reese). Four illustrations of benign melanomas of the iris in eyes with normal irides and not harboring a malignant melanoma of the choroid.



iris. In one instance the cells of the iris lesion were of about the same maturity as those of the malignant melanoma in the choroid (fig. 1 d). No endothelium has been identified over their surface. There seems to be no predilection for any particular area of the iris. There is no tendency to encapsulation.

Sections of 100 eyes not having a malignant melanoma and with normal irides were examined and iris melanomas

there was a malignant melanoma of the choroid and not present on the iris of the fellow eye. In the first case (fig. 3, plate 2), the choroidal tumor located in the macular region was flat and nonpigmented, and a differential diagnosis from other conditions was necessary. In the second case (seen through the courtesy of Dr. R. C. Castroviejo), there was a retinal detachment over the choroidal tumor and the diagnosis was not clear.

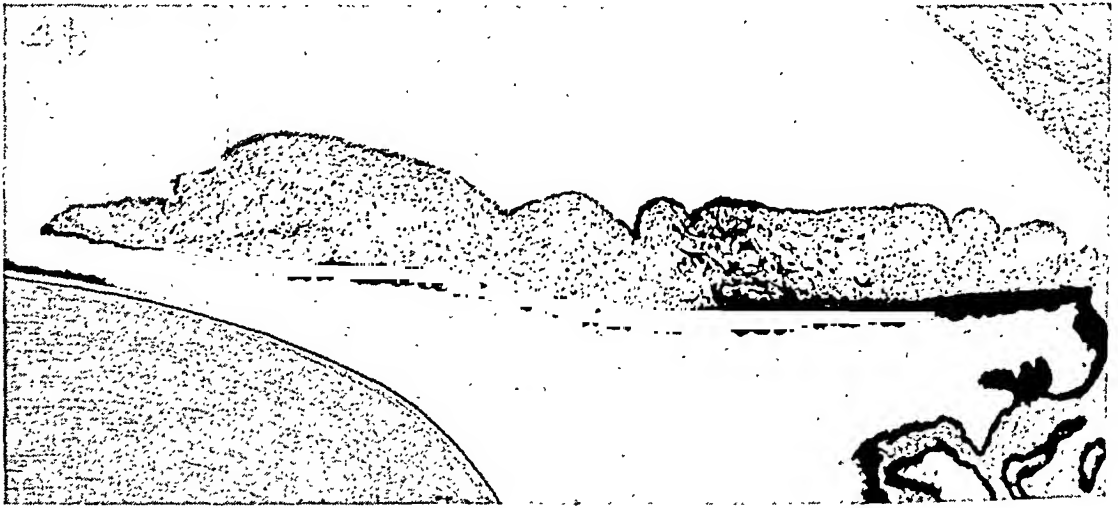


Fig. 4 b (Reese). Microscopic section through the large freckle on the iris shown in figure 4 a.

were noted in 26, or 26 percent. Four of these were extensive enough to be comparable to those seen in eyes with malignant melanoma (fig. 2). It is interesting to note that the patients in three of these four cases had an extraocular tumor but not a malignant melanoma; however, most of the normal eyes that the author has available for microscopic study are ones that have been enucleated because of a neoplasm of the adnexa.

Because of the frequency with which these melanomas of the iris have been observed in the microscopic sections of eyes harboring malignant melanomas of the choroid, the author made an effort to identify them clinically. In three instances pigment freckles have been noted as present on the iris of the eye in which

(figs. 4 a, plate 1, and 4 b). The third case (seen through the courtesy of Dr. W. A. Boyce) was one in which the lesion occupied the macular region, was flat, and had no appreciable pigment content (fig. 5). In each of these three cases freckles were present on the iris of the involved eye and not present on the iris of the fellow eye. This finding was considered significant and thought to lend substantiating evidence to the correct diagnosis. No difference was noted clinically between the appearance of these freckles and those seen in normal eyes, although the cases were not studied with this particular object in view. The fact that freckles were present on one iris and not present on the other was considered most significant. What their appearance

would have to be in order to be of significance in cases with bilateral physiologic freckles, or in cases with freckles normally more marked on one iris than on the other, is not known. From the microscopic picture there should be some clinical differences, if only for the reason that the one is more extensive than the other. A sufficient number of cases have not been seen clinically to allow any statement as to possible differences to be made. Even the most extensive ones seen microscopically were not noted clinically.

These melanomas of the iris are considered manifestations of multiple origin of the tumor. They are composed almost invariably of more matured tumor cells than is the main lesion, or of completely matured cells, and are therefore benign with little or no power of active growth. Similar instances of multiple origin of melanomas are seen elsewhere in the uveal tract. In the cases studied here the main lesion is in the choroid and the lesser lesion in the iris, but it may be elsewhere in the choroid or in the ciliary body. The main lesion, moreover, may be in the ciliary body and the lesser one in the iris or choroid, or the main lesion may be in the iris and the lesser lesion also in the iris or in the choroid.

The question of whether or not these iris melanomas are implantation growths must be considered. Such manifestations of cancer are well known. In cases of retinoblastoma implantation growths are frequently seen, and the anterior surface of the iris is not an uncommon site. Such manifestations in cases of malignant melanoma of the uvea occur but are extremely rare. They are more frequently seen when the primary growth occurs in the ciliary body and iris. In such cases the disseminated tumor cells have easy access to the anterior chamber where they may implant themselves and grow along the iris and in the filtration angle. Such

implantation growths around the circumference of the angle and iris are responsible for the ring character of some malignant melanomas (fig. 6 a, plate 1, and fig. 6 b). The melanomas of the iris discussed in this paper do not seem to be implantation growths. The cells composing them are not comparable usually

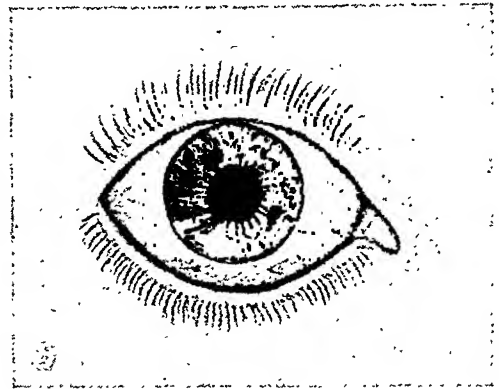


Fig. 5 (Reese). Freckles on the iris of an eye with a malignant melanoma of the choroid. There were no freckles on the iris of the fellow eye.

to the cells of the primary lesion. In only one instance were the cells of the iris lesion of about the same maturity as those of the choroidal lesion (fig. 1 d). Furthermore, the melanomas studied here tended to involve the entire iris, whereas implantation growths occur on the surface. The writer has never seen an implantation lesion of the iris from a malignant melanoma of the choroid.

In cases of malignant melanoma of the skin there may occur daughter areas or freckles around the primary focus, and these are generally said to be extensions along the lymphatics. The comparable iris lesions, however, do not seem to represent extension along the lymphatics from the primary focus but are usually multiple origins. They may very exceptionally represent implantation and, even more rarely, they may represent direct extensions by continuity along the iris surface from the primary lesion.

The question of whether the iris lesions are metastatic foci carried through the blood stream from the choroidal lesion hardly warrants consideration. The author has seen one instance of a metastasis by way of the blood stream from the primary site of the malignant melanoma in the uvea to a site elsewhere in the eye. In this case the primary lesion was

that malignant melanomas of the uvea are neurogenic in origin—it can be argued that the multiple origin of melanomas of the uvea all emanate from some common neurotrophic influence.

This is borne out in a case reported by Goldstein and Wexler.<sup>2</sup> Their patient had multiple neurofibromata of the skin, multiple pigment lesions of the skin, fi-

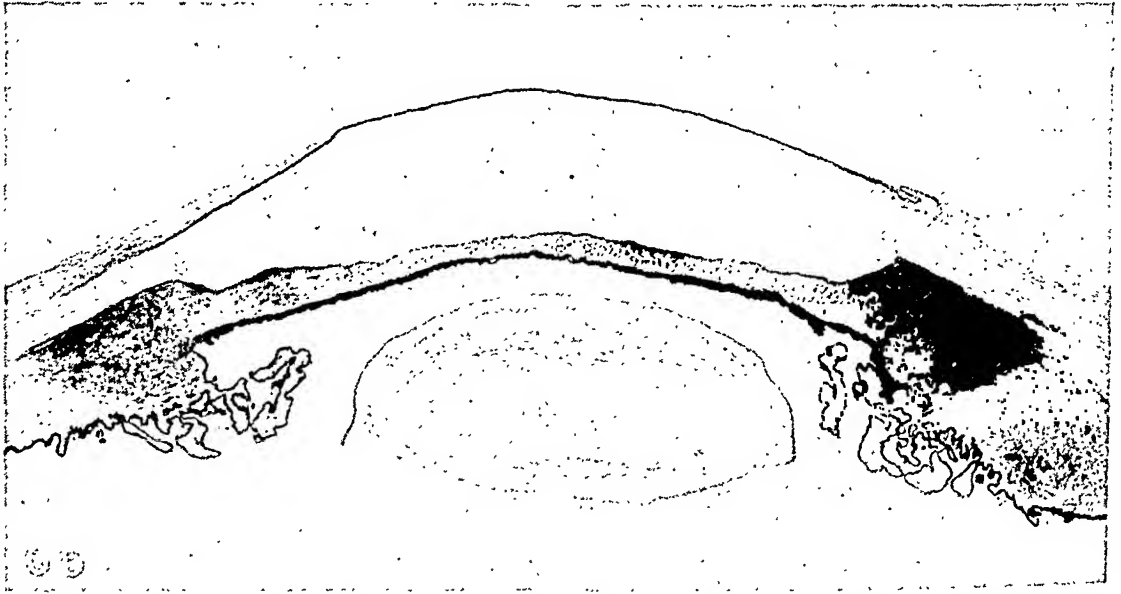


Fig. 6 b (Reese). Microscopic section of above case (line in figure 6 a indicates site of section) showing one iris growth from implantation and one from direct extension along the anterior surface of the iris from lesion in the ciliary body. Other sections showed iris lesions which were instances of multiple origin.

in the choroid and the small metastatic focus was in the vascular layer of the ciliary body on the opposite side.

*The nature of these multiple origins.* Benign pigment lesions in the form of melanosis (café-au-lait spots) and nevi occur in the skin and tissue adjacent and distal to such neurogenic tumors as neurofibromatosis. Also, the common skin nevus is thought to be neurogenic. Thus, there seems to be some relationship between pigment production and nerve-tissue function or aberration. Assuming therefore that Georgiana Dvorak-Theobald's<sup>1</sup> contention is correct—namely,

bro sarcoma of the back, and multiple melanomas of both irides. There were also stigmata of acromegaly and other features indicating tumor involvement of the central nervous system. This case illustrates the multiple origin of melanomas, associated with multiple neurogenic tumors, manifesting one malignant focus as well as innumerable benign foci all over the body, including the irides.

In cases of neurofibromatosis sometimes the multiple manifestations of the disease, including the pigment lesion, tend to follow the distribution of a nerve. In cases of malignant melanoma of the uvea the iris melanomas do not seem neces-

sarily to appear in the same quadrant or sector of the eye, indicating the same nerve distribution.

Another conception of the multiple manifestation of melanomas is that some cancerigenic agent acts on the whole uveal tract causing a malignant melanoma at one site and more or less benign melanomas at other sites. There are similar occurrences elsewhere in the body. Among these can be mentioned cancerous lesions that occur simultaneously throughout the gastro-intestinal tract (mouth, esophagus, stomach, and rectum). Also, there may be papillomatous lesions over a wide area of the gastro-intestinal tract; epitheliomatous lesions over the face with simultaneous and widespread multiple precancerous lesions, in which instance the cancerigenic agent is thought to be the actinic effect of the sun's rays; in the mouth there may occur multiple carcinomas and precancerous lesions that are thought by some to have a common cause in syphilis, in avitaminosis, or perhaps in the use of tobacco. Lymphosarcoma may manifest itself for a long time at one site as a localized tumor and later show multiple origins elsewhere. Both breasts and both ovaries may be simultaneously affected with cancer or precancerous lesions. The multiple origin of a retinoblastoma not only in the one eye but in both eyes is well known, and the primary site is malignant, whereas the secondary sites may be relatively benign. In all of these instances there seems to be some common agent or factor at work producing tumor changes of varying degrees over a wide area of a particular system. Verhoeff has suggested that some substance may emanate from the main lesion causing a localized proliferation of melanoblasts elsewhere in the uvea.<sup>3</sup>

Two instances in which the main lesion was in the iris or ciliary body and

the lesser lesion in the iris serve to indicate certain characteristics. In the one case there was a malignant melanoma of the iris with four pigment freckles on the iris at the side opposite to the tumor. There were two small freckles on the fellow iris. The tumor was excised locally by Dr. John M. Wheeler and the microscopic diagnosis was malignant melanoma. Seven years have now passed during which time there has been no recurrence of the tumor nor have the pigment freckles, which were not excised, grown. This case bears out the fact that the freckles are composed of mature cells with little or no power of active growth. In the other case, a flat melanoma, measuring 1 by 3 mm., was noted in the periphery of the iris during a routine examination (fig. 7 a, plate 2). Presumably the lesion had been present for an indefinite length of time. Observations were made regularly every three to six months. Gonioscopic examinations, drawings, and photographs were made at varying intervals. No change was detected during the period of observation until after the passage of eight years, when it was noted with the gonioscope that the anterior chamber angle could no longer be seen over the site of the tumor, indicating an increase in elevation. At the same time two freckles appeared on the iris above the main lesion. These had appeared in six months' time. After two-and-one-half months more a third freckle appeared above the other two. The main lesion still measured 1 by 3 mm. The eye was enucleated. Microscopically, the tumor proved to be a malignant melanoma arising apparently from the site of a benign melanoma (fig. 7 b). The pigment freckles were composed of more matured cells than was the main lesion and seemed to represent multiple origins of the tumor (fig. 7 c). They appeared coincidentally with the active growth of the main lesion,



Fig. 7 b (Reese). Microscopic section of iris melanoma shown in figure 7 a. This is a malignant melanoma apparently arising from the site of a benign melanoma.

Fig. 7 c. Microscopic section through the freckle shown in figure 7 a.



Fig. 8 (Reese). A diffuse malignant melanoma of the choroid which has extended out of the globe at the posterior pole. There is a detachment of the retina and secondary glaucoma.

which fact suggests that their appearance on the iris indicates active or malignant growth of the main lesion.

*Relation of the iris melanomas to malignant melanoma of the uvea in gen-*

*eral.* A malignant melanoma of the uveal tract is usually a localized tumor mass; occasionally, however, it manifests itself as a diffuse lesion involving sometimes the entire uvea (fig. 8). It may also appear as a diffuse lesion involving only a

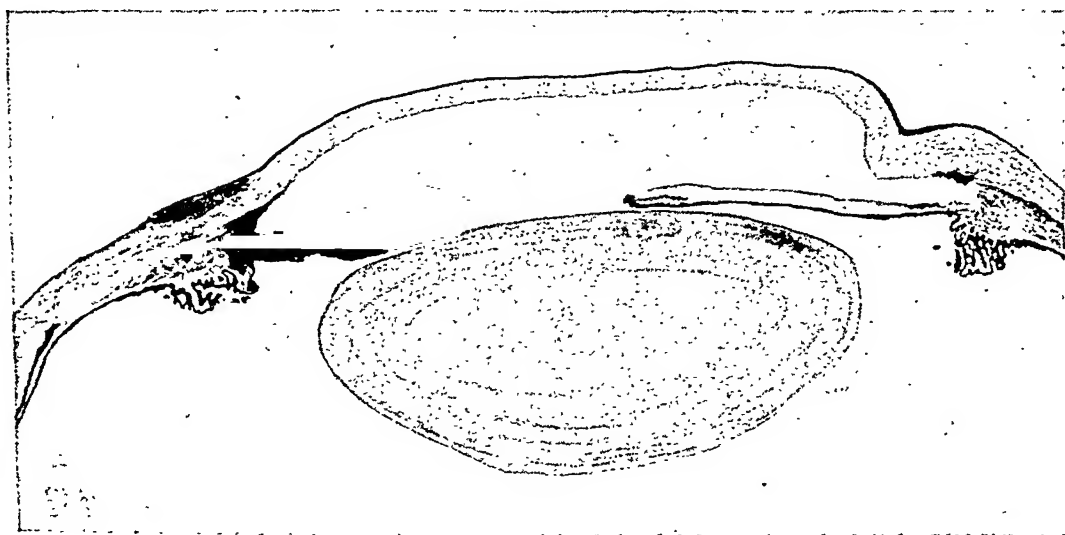


Fig. 9 b (Reese). Microscopic section of above case (line in figure 9 a indicates site of section).

portion of the uvea, such as the iris (fig. 9 a, plate 2, and fig. 9 b) and/or the ciliary body (fig. 6 b). The malignant melanoma occurring as a localized mass in the uvea, with benign melanomas elsewhere, seems to be the bridge or link between the usual type of localized malignant melanoma of the uvea and the diffuse malignant melanoma. The cancerigenic factor has its effect at a localized site alone (usual localized malignant melanoma of the uvea) and to a lesser degree elsewhere (malignant melanoma at one site and benign melanoma elsewhere), or in a diffuse manner over the uvea (diffuse malignant melanoma of uvea or iris and ciliary body, or ring melanoma). The ring nature of a melanoma seems to be due in part to multiple diffuse origins as well as to implantation growths which logically occur around the filtration angle where disseminated tumor cells in the anterior chamber would tend

to gather. An important difference between a localized malignant melanoma of the uvea with benign melanomas elsewhere, and a diffuse and ring type of melanoma, is that the cancerigenic agent had a malignant effect at one site and a benign effect elsewhere in the one case and a diffuse, multiple malignant effect in the other cases.

#### CONCLUSIONS

A malignant melanoma of the uvea may be accompanied by a single or by multiple benign melanomas. Such instances represent multiple origin of the tumor, and the iris is a common site for the benign feature. When the iris lesion is seen clinically it is a diagnostic aid.

I wish to express my appreciation of the assistance rendered by Miss Lilly Kneiske.

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# SOLAR KERATOCONJUNCTIVITIS ASSOCIATED WITH AMBLYOPIA\*†

## REPORT OF TWO CASES

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Although no reports have been found in a study of the literature concerning amblyopia associated with the exposure of the eyes to ultraviolet rays, the widespread use of ultraviolet-producing lamps makes it likely that more cases similar to those presented in this paper will be reported or have occurred.

Two brothers, J. H., and G. H., white, 23 and 26 years of age, respectively, purchased a small, inexpensive carbon-arc lamp which consisted of a reflector with two exposed carbons. With this lamp, they gave themselves three 15-minute periods of irradiation within 48 hours. The exposure was made with the patients seated about three feet in front of the lamp, facing it, with no protection for the eyes and with the eyes kept open most of the time.

Approximately six hours after the last exposure the patients complained of severe ocular pain, photophobia, and lacrimation. On January 25, 1939, six hours after the onset of the symptoms they were admitted to the New York Eye and Ear Infirmary. Examination of each patient showed slight redness and swelling of the eyelids with marked blepharospasm. There was profuse lacrimation and moderate diffuse redness of the conjunctiva. When the corneas were stained with fluorescein, a diffuse stippling re-

sembling superficial punctate keratitis was seen. Because of the intense photophobia and blepharospasm accurate determination of the visual acuity and satisfactory examination of the fundi could not be made.

Symptomatic treatment was administered, consisting of mydriasis with 2-percent homatropine, cold bathing, the use of boric-acid ointment, analgesics, and sedatives.

The following day the patients were comfortable but vision was reduced to the perception of hand movements. Examination of the fundi, while not entirely satisfactory, seemed to show no abnormality.

Two days after admission the pain, photophobia, lacrimation, and redness had completely disappeared, but the vision remained unimproved. A thorough fundus examination revealed nothing abnormal.

Peripheral visual fields were studied on the third day, January 28, 1939, using the Ferree-Rand perimeter. The vision of the first patient, J. H., was perception of hand movements. In testing his visual fields a 15-mm. white test object was used at 330 mm. with 7.5 foot-candles of illumination. The fields were reduced to a small temporal crescent in each eye (fig. 1.) On January 30th, the vision was the same and the fields unchanged. A light field was performed later on the same day, at which time vision had improved to the counting of fingers at 24 inches in each eye. The light field showed

\*From the New York Eye and Ear Infirmary.

†Aided by a grant from the Ophthalmological Foundation, Inc.

a bitemporal hemianopsia (fig. 2).

On February 1, 1939, the vision was the same but the temporal crescents were larger when the visual fields were tested. The following day, vision had improved slightly and the visual fields had changed, the nasal field was beginning to be restored but there was still a large central scotoma (fig. 3). On the following day, February 3d, there was a return of vision (as tested with the pinhole) to R 20/100 and L 20/40 and the central and peripheral visual fields, as tested with the 3/330 white test object, were almost normal. On February 6th, the visual fields showed in the right eye, a relative central scotoma for blue of 4 degrees, with a marked contraction of the inferior temporal quadrant as tested with 1/750 white test object. The left eye showed a relative central scotoma for blue about 4 degrees and for green about 2 degrees with approximately normal fields (fig. 4).

Homatropine refraction was performed, and when the patient was last seen on February 21, 1939, the vision was: R.E.  $-4.00D.$  sph.  $\approx -0.50D.$  cyl. ax.  $30^\circ = 20/20-2$ ; L.E.  $-2.00D.$  sph.  $= 20/30$ ; 300 mm. print could be read at 140 mm. with each eye.

The course of the second patient, G. H., and the visual-field changes paralleled those of his brother. On January 28 and January 30, 1939, the vision was reduced to perception of hand movements in each eye. The visual fields as tested with the 25-mm. white test object at 330 mm. showed only a temporal crescent to be present (fig. 5). The light fields taken on January 30, 1939, did not show the hemianopsia that was seen in the first patient but were more uniformly contracted. On February 1, 1939, vision was: R.E., the ability to count fingers at 8 inches; L.E., finger counting at 14 inches. The visual fields were quite uniformly and markedly contracted, but no central

scotoma was demonstrated with the size test object used (fig. 6). By February 3, 1939, the vision (as tested with the pinhole) was: R.E. 20/40-1 and L.E. 25/30; the central and peripheral fields, as tested with the 3/330 white test object, were almost normal. On February 6, 1939, the visual field showed an absolute central scotoma for green of 2 degrees in each eye and normal central fields as tested with the 1/750 white test object.

With the correction which the patient was wearing (R.E.  $-2.25D.$  sph.  $\approx -0.25D.$  cyl. ax.  $90^\circ$ , and L.E.  $-2.25D.$  sph.  $\approx -0.50D.$  cyl. ax.  $90^\circ$ ), his vision was 20/20 in each eye.

In both patients, the general physical and complete neurologic examinations (except for the visual findings) showed no abnormalities. Roentgenograms of the accessory nasal sinuses and sella turcica were normal. Complete blood counts and urinalyses were within normal limits. The blood Wassermann reactions were negative.

Repeated fundus examinations, including one made with the binocular ophthalmoscope and with the red-free filter, showed nothing abnormal.

#### COMMENT

The carbon-arc lamp is a convenient source of ultraviolet radiation. This radiation depends upon the amount of current used and the type of carbon that is employed. The neutral (pure carbon) core carbon arc is rarely used. Carbons impregnated with "rare earth" oxides—yttrium and the like,<sup>1</sup> iron oxide, calcium oxide, and strontium—are used. In order to obtain sufficient radiation for effective therapeutics a lamp must be one of high amperage. In general, carbon-arc lamps give off radiations from 2,200 to 40,000 A.U.

For ordinary purposes it may be con-

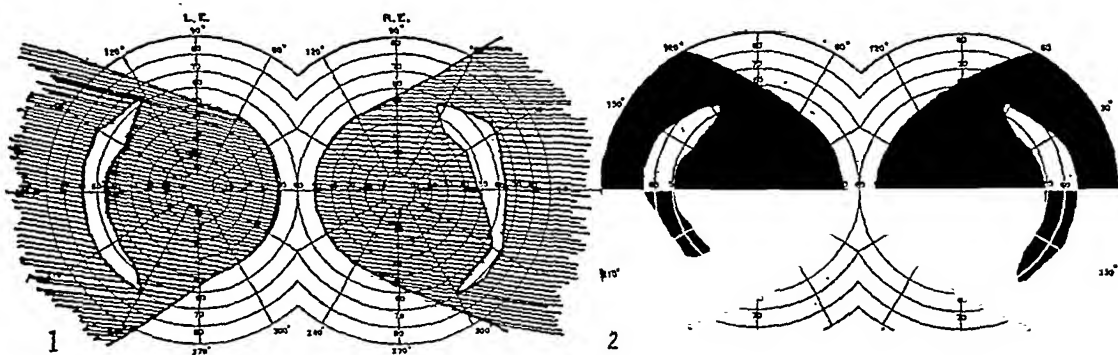


Fig. 1 (Berens and McAlpine). Mr. J. H., aged 23 years. Date: January 28, 1939. Vision without correction: R.E., hand movements; L.E., hand movements. With correction: R.E., fingers at one foot; L.E., fingers at one foot. Correcting lenses were worn during the test. Size of test object: R.E., 15 mm.; L.E., 15 mm. Illumination was 7.5 foot-candles.

Fig. 2. Mr. J. H. Date: January 30, 1939. Vision without correction: R.E., hand movements; L.E., hand movements. Size of test objects: R.E., 15 mm./330; L.E., 15 mm./330. Illumination was 7.5 foot-candles.

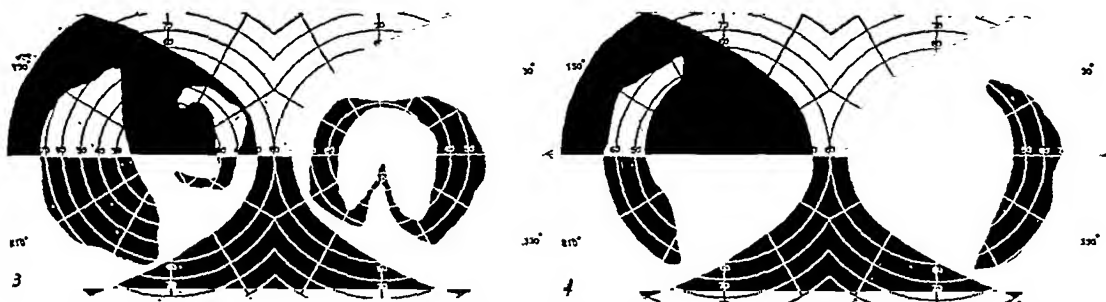


Fig. 3 (Berens and McAlpine). Mr. J. H. Date: February 2, 1939. Vision without correction: R.E., fingers at 2 inches; L.E., fingers at 3 inches. Size of test objects: R.E., 10 mm./330; left eye, 10 mm./330. Illumination was 7.5 foot-candles.

Fig. 4. Mr. J. H. Date: February 6, 1939. Vision without correction: R.E., fingers at 2 inches; L.E., fingers at 2 inches. Size of test objects: right eye, 15 mm./330; left eye, 15 mm./330. Illumination was 7.5 foot-candles.

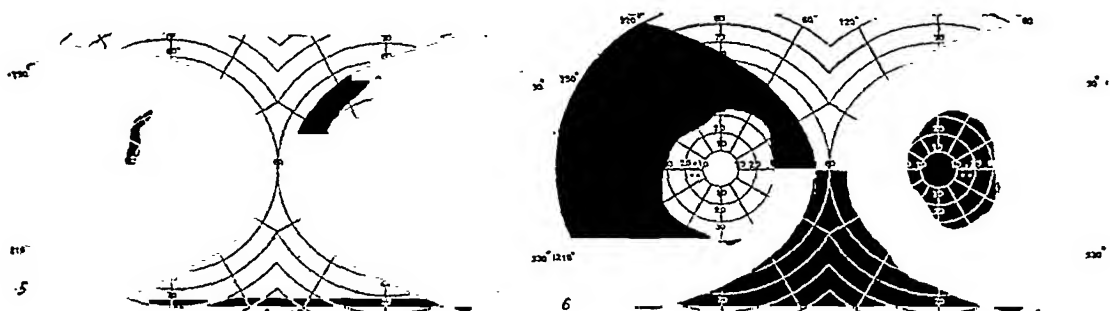


Fig. 5 (Berens and McAlpine). Mr. G. H., aged 26 years. Date: January 28, 1939. Vision with correction: R.E., hand movements; L.E., hand movements. Size of test objects: R.E., 25 mm.; L.E., 25 mm. Illumination was 7.5 foot-candles.

Fig. 6. Mr. G. H. Date: February 1, 1939. Vision without correction: R.E., fingers at 8 inches; L.E., fingers at 14 inches. Size of test objects: R.E., 15 mm./330; L.E., 15 mm./330. Illumination was 7.5 foot-candles.

sidered that radiations about 15,000 A.U. (infrared rays) are totally absorbed by the media of the eye. Below this the amount reaching the retina gradually increases, according to Hartridge and Hall, until at 9,000 A.U., 90 percent is transmitted. The high transmissibility is maintained through the visible spectrum, until 4,000 A.U. is reached, when absorption by the lens begins again. Absorption by the lens increases until at 3,200 A.U. transmission to the retina ceases.<sup>2</sup> It has been estimated that approximately 3 percent of the total heat incident upon the eye reaches the retina.

Another factor that determines the amount of incident energy to reach the retina at any one point is that of concentration. This depends upon the size of the source of energy and upon the dioptric system of the eye; the smaller and more concentrated the source the greater the concentration of energy at the retina in any one spot. Thus, retinal damage may occur without injury to the structures of the eye anterior to it.

The retina may be affected by light in one of three ways: There may be the sensation of vision; there may be a thermal effect; and there may be a chemical or abiotic effect. It may readily be seen how the first two take place, but the mechanism by which the latter occurs is more obscure. For practical purposes only rays below 3,000 A.U. may be considered abiotically active,<sup>3</sup> and it has been shown that no rays below 3,000 A.U. reach the retina. However, it has been demonstrated by Duke-Elder<sup>4</sup> that the abiotic effect in the retina can occur. It is probable that if this is caused by direct abiotic action the retina may be sensitized to rays longer than those to which it usually responds. Or it may be, as Birch-Hirschfeld<sup>5</sup> suggests, that the changes are the result of an overstimulation of the physiologic mechanism of vision.

The literature concerning ultraviolet irradiation of the eyes is not extensive. Lear<sup>6</sup> reported three cases of ophthalmia due to exposure to ultraviolet rays. He found a definite latent period (within 24 hours) between the time of exposure and the onset of the symptoms of pain and photophobia. The retina did not appear to be damaged in his cases.

Four cases of central retinitis from looking at a solar eclipse were reported by Makarov.<sup>7</sup> He found that the scotomas appeared within 15 minutes, whereas the latent period in electric ophthalmia was much longer. In a detailed review of the literature, and a study of 11 cases caused by the solar eclipse in 1912, Klang<sup>8</sup> found that in half of the cases there were central or paracentral scotomas, with denser central portions. He found that the ophthalmoscopic findings were not proportional to the visual disturbances, there being cases with scotomas but no fundus changes, and vice versa.

Epeleers<sup>9</sup> made an exhaustive study of 13 cases of eclipse blindness during the summer of 1912. In 6 of these he found a ring scotoma, and in 11 there was a slight enlargement of the blind spot.

Four patients under observation by Carmazza<sup>10</sup> showed, following observation of a solar eclipse, dark red maculas with radial gray striations, round white spots, and grayish surrounding retina. In three of the four cases all symptoms disappeared in a short time.

Ultraviolet irradiations of the eyes of rats by Reichling<sup>11</sup> produced severe reactions in the structures of the eye anterior to the retina but no mention is made of retinal changes.

Similar irradiation of rabbits' and guinea pigs' eyes by Rohrschneider<sup>12</sup> produced only corneal and lens changes.

It is probable, because of the relatively short exposure, that in the two cases reported in this paper temporary func-

tional changes in the retina or visual pathways resulting in contraction of the visual fields and temporary amblyopia were the result of the thermal action of the carbon-arc light. That this type of ultraviolet lamp may be sold over the counter without goggles or sufficient warning concerning the danger to vision is a condition which should be considered in the interest of the conservation of vision.

## SUMMARY

1. Two brothers were exposed to an open carbon-arc lamp for three 15-minute periods within 48 hours. 2. Following

this, vision was reduced to the perception of hand movements and the visual fields to a temporal crescent in each eye. 3. There was gradual recovery in the course of 11 days, both of visual acuity and visual fields. 4. Consideration of effects of ultraviolet radiation make it probable that the contraction of the visual fields and temporary amblyopia in these patients were caused by the thermal effect of the carbon-arc lamp.

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# LESS EVIDENT CAUSES OF LOWERED ACUITY IN SENILITY\*

INCLUDING A DISCUSSION OF A CASE OF ENDOTHELIAL DYSTROPHY AS THE CAUSE OF BULLOUS KERATITIS BY F. H. VERHOEFF, M.D., *Boston*

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Only those who have used the binocular corneal microscope of Csapsky, with its weak, diffuse illumination, can appreciate the genius of Gullstrand, who used the same binocular and by adding

It revealed details of corneal diseases that had previously escaped observation and diagnosis. Most of these triumphs concern younger persons, but the degenerative conditions of the postcorneal



Fig. 1 (Lloyd). Myopia of 6 diopters. Vision but little affected. Tension at times a few points above the high limit. The fibrin bits are numerous and, although they appear here as if limited to the central zone, are easily seen everywhere if the light is shifted.

the slit of light made the instrument next in importance to the ophthalmoscope.

\* Read before the American Ophthalmological Society at Hot Springs, Virginia, June, 1943.

endothelium are peculiar to older patients. Pigmented dots in varying number may be seen upon the posterior corneal surface of many older patients by

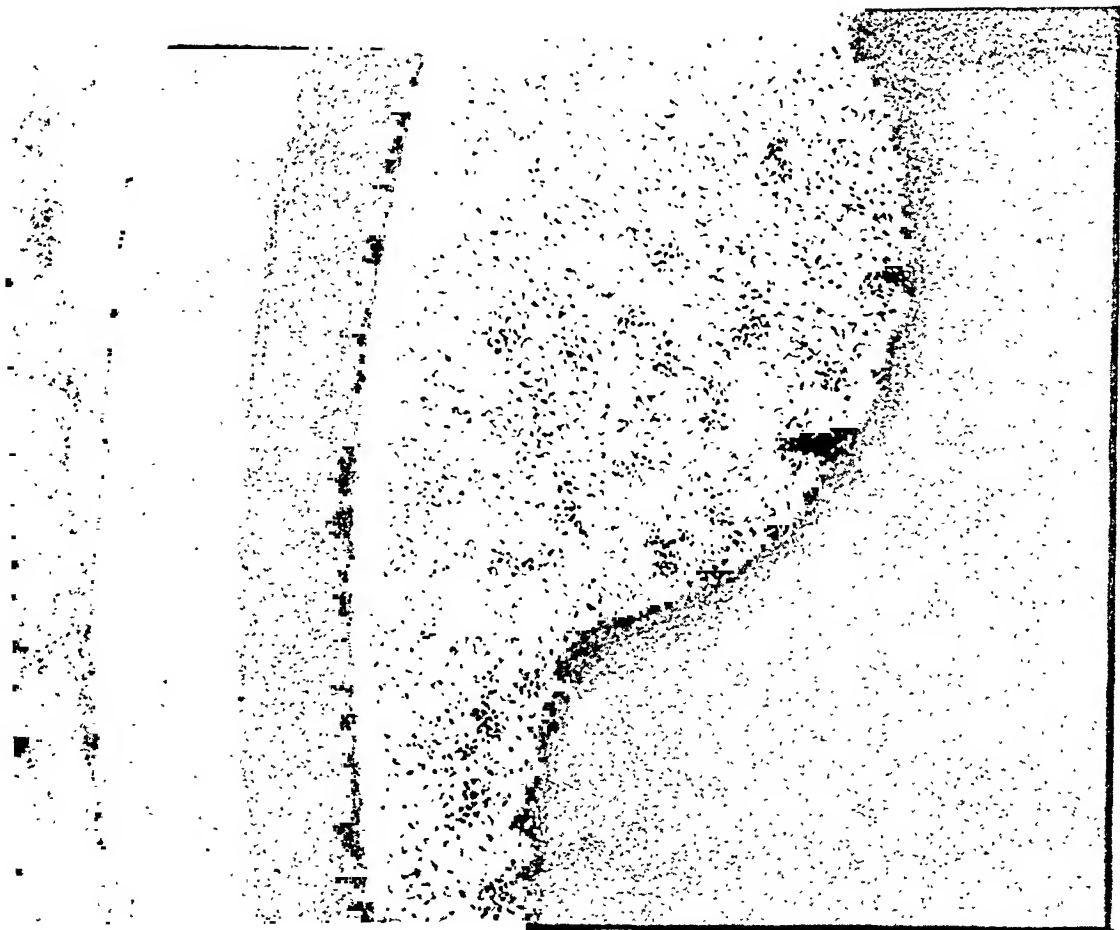


Fig. 2 (Lloyd). Cornea farinata. Hyperthyroid, appearance sudden, moderate effect upon the vision. Lens changes followed in a few months.

retroillumination, but the eyes function well and the patient enjoys good vision. These deposits may increase in number or change in character, especially after cataract extraction, but even then cause no fears for the future of the eye. In some cases, with profuse discrete deposits, there is lowered acuity and occasionally slight rise of tension. After successful trephining, pigmented bits are deposited in large numbers on the posterior corneal and lenticular surfaces, with formation of synechiae and, although the distance vision may fall perceptibly, reading ability may be satisfactory. Forward movement of the lens and early cataractous changes are associated features, but the source of the deposits is

unexplained (figs. 1, 2, 3). A cloud of pigmented bits is an unfavorable omen in cases of diabetes, hyperthyroidism, or presenility.<sup>1</sup> An advanced state of this form of postcorneal pathology is the cornea guttata which Vogt asserts is the early stage of Fuchs's dystrophy.<sup>2</sup> This slitlamp picture is very clear, showing droplets and pigmented bits on the posterior surface and an increase in the number of Henle's warts.<sup>3, 4</sup> There seems to be an endothelial degeneration which allows the aqueous to seep into the deeper layers of the cornea with subsequent trophic changes that feature Fuchs's dystrophy. The epithelium becomes edematous, sensation is lowered, and the cornea cannot withstand the ordinary ex-



posure of daily life. Minute pockets of fluid in the edematous epithelium tend to coalesce, forming blisters that become infected when the cover is lost, and the eye is ruined unless new tissue is formed be-

under the microscope and found the endothelial defects which permitted aqueous infiltration into the corneal stroma.

Dr. Verhoeff has sent me the following description of an unpublished case of

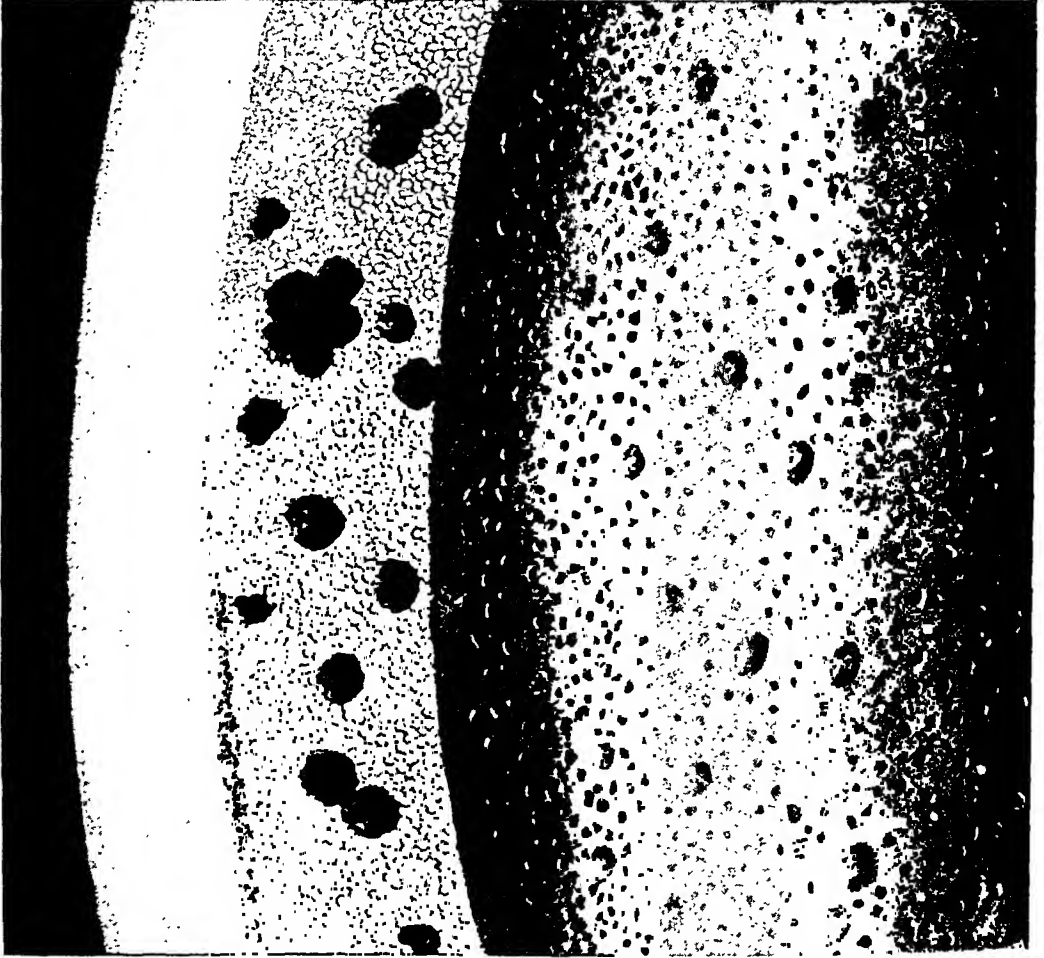


Fig. 3 (Lloyd). Slitlamp view of cornea guttata in a woman aged 74 years. Moderate reduction of vision, eyes uncomfortable.

neath the epithelium.<sup>5, 6, 7, 8</sup> Protective devices may prevent ulceration and secondary infection, but, in any event, vision is very poor. In the early stage these patients may say vision is poor upon awakening but improves after being up and about. This improvement is due, apparently, to massage of the edematous epithelium by the upper lid. As is well known, each of these cases is one of potential glaucoma. Vogt studied such eyes

epithelial dystrophy in which he examined the eye microscopically 17 years ago: "The patient, then aged 75 years, was brought to me in 1926 by a young colleague. The left eye showed a typical picture of Fuchs's epithelial dystrophy. Its vision was markedly impaired, and there were mild symptoms of irritation. The other eye was slightly, if at all, affected. The irritation increased, and, finally, about six months later, became

so severe that my colleague removed the left eye and sent it to me for microscopic examination.

"A median vertical section of the cornea showed these changes: From the

and, where covered with 'endothelium,' was sharply defined. Near the center of the cornea, for a stretch of 3 mm., the 'endothelium' was entirely absent, and here the surface of the new layer of

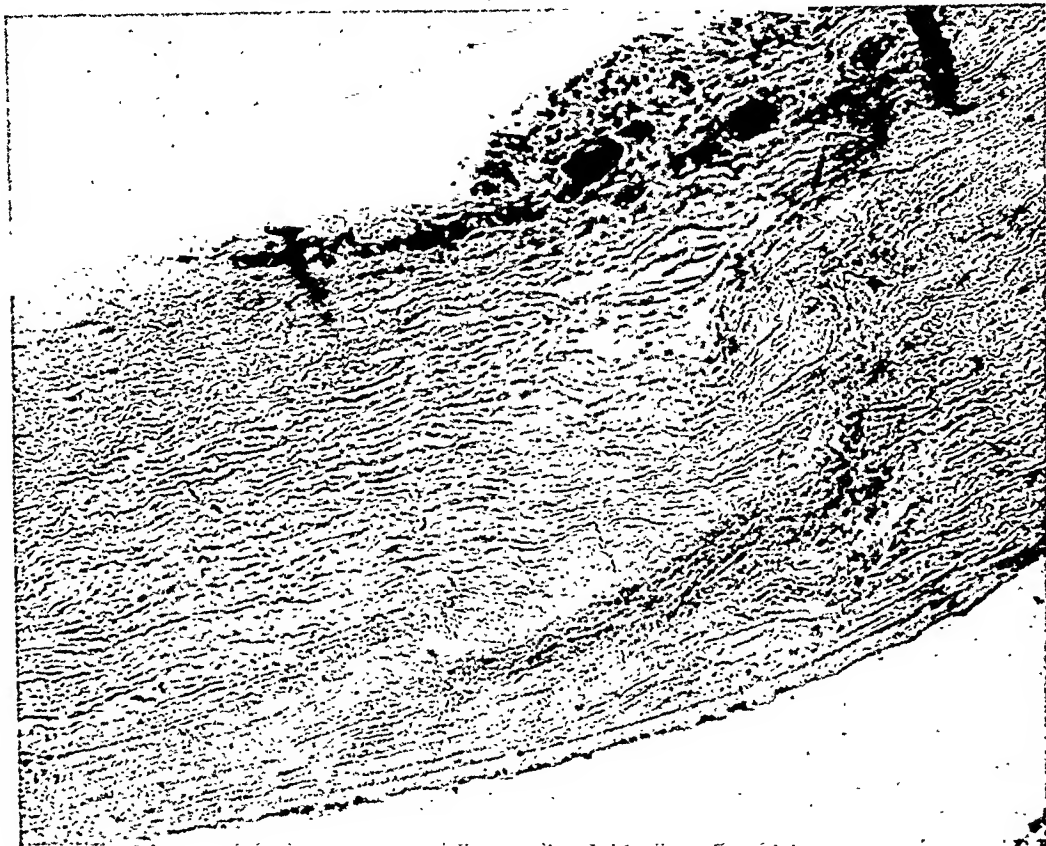


Fig. 4 (Verhoeff). Section of cornea. Case of epithelial dystrophy. Upper periphery of cornea, showing small warts on Descemet's membrane and small defects in the abnormal endothelium. Elsewhere the changes were different and much more marked.

periphery above, for a distance of 0.75 mm. Descemet's membrane was slightly thickened and showed many warts, most of them small. Beneath it the 'endothelium' was greatly altered, and in minute areas, absent (fig. 4). Elsewhere there were no warts. At the periphery below, the 'endothelium' was completely absent for a distance of 0.75 mm. Behind most of the cornea, an additional layer of Descemet's membrane had been formed, about one half the thickness of the old. This was composed of an almost transparent substance that stained feebly

Descemet's membrane was fuzzy. Elsewhere the new membrane was largely covered with 'endothelium' which, however, was abnormal in that the nuclei were scanty, thin, and elongated. Probably the 'endothelium' had previously been lost here, and then poorly re-formed.

"On the anterior surface of the cornea, the epithelium was intact but, just below the center, was characteristically thickened as in bullous keratitis, and separated from Bowman's membrane in the form of a large flat bleb. Here, immediately beneath Bowman's membrane, were two

nodules, produced by proliferation of the corneal corpuscles. Each was about 0.25 mm. in diameter, and 0.12 mm. in thickness. In this region, in the middle layers of the stroma, there were a few fairly large blood vessels. From the corneal limbus below, fine vessels had extended for a distance of 0.75 mm. between the epithelium and Bowman's membrane—the merest trace of beginning pannus degenerativus.

"The eye showed no evidences of glaucoma—there were no peripheral anterior synechiae, nor was there the slightest cupping of the optic disc. The retinal ganglion cells were intact. The choroid showed very slight sclerosis of its vessels, and insignificant infiltration with lymphocytes. Otherwise the eye was normal except for common senile changes; notably, hyaline degeneration of the ciliary processes, and marked proliferation and degeneration of the pigment epithelium behind the macula.

"From these findings, I attributed the epithelial dystrophy to the changes in and loss of the corneal 'endothelium.' The 'endothelial' changes seemed to me analogous to senile changes of the pigment epithelium. First there had occurred senile hyperplasia of the 'endothelium,' producing in places a new layer on Descemet's membrane, and then degeneration with final denudation. No doubt, even before the denudation occurred, the altered 'endothelium' permitted the aqueous to permeate the cornea and affect the epithelium.\* Finally the process led to bullous keratitis with secondary vascularization of the cornea. This case proves that formation of warts is not essential to the process—the hyperplasia of the endothelium may produce, not warts, but

duplication of Descemet's membrane. In this connection it is to be noted that just as colloid excrescences of the pigment epithelium may occur in young adults, so may cornea guttata. Whether the latter always ultimately produces epithelial dystrophy, I do not know, but certainly many years may elapse before it does so. Of course, the epithelial dystrophy is produced neither by warts nor by duplication of Descemet's membrane, but by the associated alteration of the 'endothelium,' and by this alteration only when it has become severe. No doubt, no two cases would be exactly alike in respect to the endothelial changes. The important fact is that epithelial dystrophy is produced by a degenerative change in the endothelium. Usually, this can be regarded as atrophic, even when the eye is not otherwise senile, but probably in some cases it is secondary to other changes in the eye. Any type of cataract operation injures the endothelium, more or less. In some cases, for unknown reasons, the injury is never fully repaired and epithelial dystrophy results. In some cases, the epithelial dystrophy is probably due to persisting contact of the vitreous and cornea. The reason why 'endothelium' is inclosed in quotation marks is because it is not really endothelium but 'mesenchymal epithelium.' "

Only the early stages of Fuchs's dystrophy are likely to escape notice. The first objective signs are anesthesia of the cornea with edema of the surface epithelium. Which comes first is a question, but the patient's attention is attracted by fading vision. There are no early characteristic symptoms of this syndrome but it is rarely seen in satisfactorily functioning eyes. The stubborn and troublesome group of symptoms usually diagnosed chronic catarrhal conjunctivitis, requires careful study to avoid missing early

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\* D. G. Cogan (Arch. of Ophth., 1941, p. 941) has satisfactorily explained how, under such conditions, vesicles and bullae are formed.

Fuchs's dystrophy (cornea guttata) and keratitis sicca (keratitis filamentosa). Treatment is fruitless and vision is lost as new tissue forms a protecting barrier beneath the epithelium (fig. 5). Fuchs has

tension and careful observation afterward. If there is the slightest evidence of elevation of tension, a trephining should be done with complete iridectomy. If the eye reacts well, the extraction

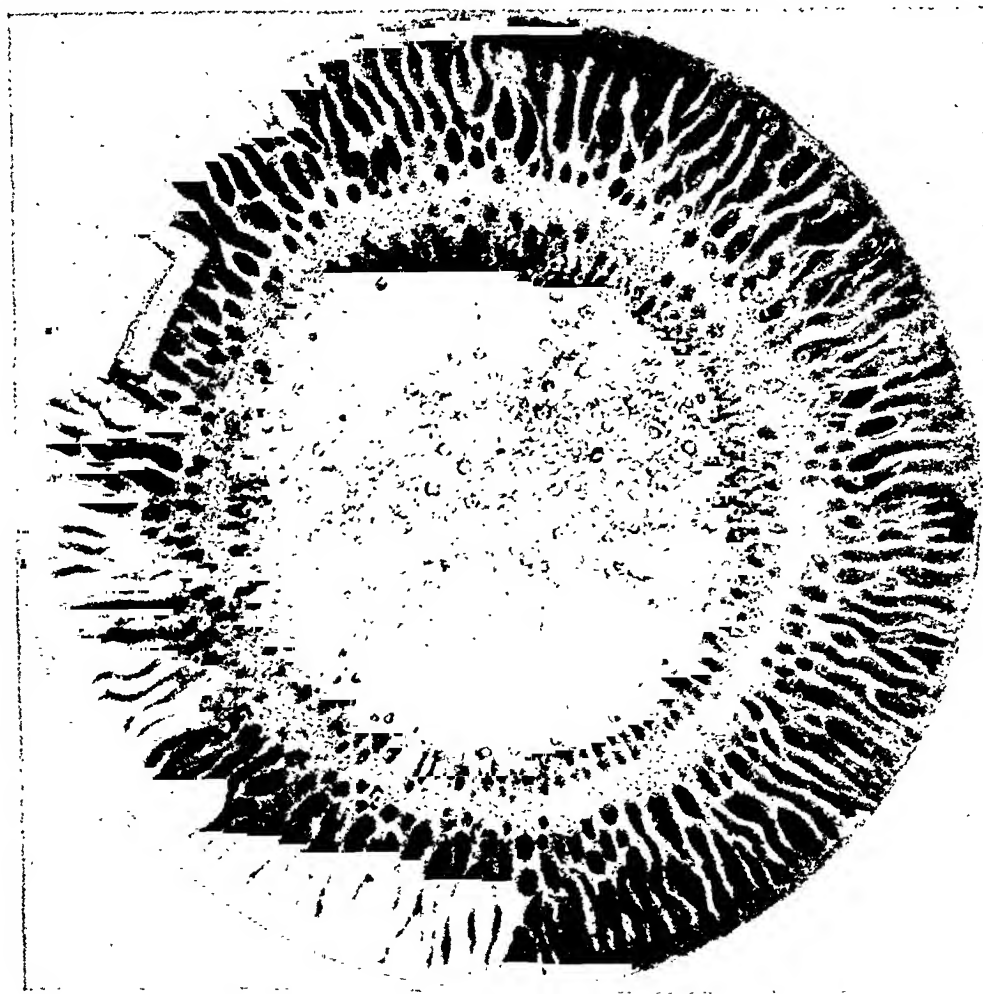


Fig. 5 (Lloyd). Slitlamp view of Fuchs's dystrophy in the early stage of epithelial edema.

reproduced this condition in animals by irrigating the anterior chamber, but that cannot explain the occurrence after cataract operation, when no irrigating has been done, irrespective of the type of operation.

Slitlamp study is a part of the routine before cataract surgery, and if cornea guttata is found, the operation should be performed with preliminary taking of the

should follow. If, later, this eye develops the characteristic changes of dystrophy with elevation of tension, the second eye should be operated on, despite the gloomy outlook, unless the changes in the corneal surface have already appeared. Measures to overcome rise of tension should be undertaken on the slightest provocation. Fortunately, many of the patients who have bedewing of the posterior corneal

surface, escape further trouble. In some, the changes are unilateral, at least for some years. It may seem that too much stress is placed upon the tension element, but the onset is so gradual that it may be overlooked at the time when treatment can give results.

A very similar corneal dystrophy occurs after cataract surgery (fig. 6). Whether this is latent Fuchs's dystrophy stirred

of fundus lesions escape the hand-scope now in common use. Red-free light and binocular ophthalmoscopy supply useful details in certain cases, but it would seem as if the limit of efficiency had been attained in this particular direction.

Until direct examination was made the easier of the two methods, there was room for difference of opinion as to many fundus cases. The better instru-



Fig. 6 (Lloyd). Epithelial dystrophy after operation for cataract. Advanced stage. Patches of edema with large irregular bleb.

into activity, or whether it arises *de novo* after operation, is not yet clear. Dr. Verhoeff's comment on this question is most illuminating and practical.

The ophthalmoscope came into use in 1851. It made ophthalmology a specialty and became at once the most important of our diagnostic instruments. About 25 years ago, the electric lamp was arranged for its illuminating system, making such an effective instrument that only details

ment and the pathologist have cleared up many hindrances to correct diagnosis, but many eyes with unusual lesions do not come to the laboratory, so our knowledge is not so positive as we would like. It behooves us to collect and compare our case reports, in order to create a reliable and informing literature.

An unobtrusive fundus picture seen among our older patrons is ushered in by high reflexes in the macular area (fig. 7).

The choroid looks "meaty" and the retinal capillaries are tortuous. The vision may be almost normal, although to the examiner's eye the retinal surface throws a sheen like watered silk. The binocular ophthalmoscope will show the uneven surface of the retina as the finer vessels cross the affected area. When the sheen is very strong, the vision falls and red-free light shows this flare to be a lacy film in the retina. A few of these eyes under observation have developed a hole in the macula after slight accidents or spontaneously.

This condition has been seen in diabetes, and vitamins A and B seem to be of definite value. They were prescribed to supply the deficit occasioned by elimination of starch and sugar from the diet and the diabetic's inability to use fats. Other patients get along as well with or without vitamins. I do not know of any eyes of this type examined by the ophthalmoscope and later by the pathologist. Judging from Kuhnt's description<sup>9</sup> and the later appearance of the hole in the macula in these cases, this is probably the rarefying atrophy of the retina he described. While this change is going on, it is not unusual to see a thinning of the tapetum in the nasal fundus, exposing the deeper choroidal vessels with early sclerotic changes here and there.

Another senile change in and about the macula is the appearance of small pigmented spots in the macula some time after the patient has complained of a feather or a "bug" near the fixating point. At first, the annoyance occasioned is out of proportion to the effect upon the patient's ability to read test type, but later a definite scotoma appears with corresponding loss of vision. It is doubtful if the pigment spots which eventually may be very clearly seen in the macula are causing the loss of vision; they may rather be an indication of disease in the

pigment layer and in the rods and cones, of which process the pigment is a by-product. Both eyes are usually affected but the disease may appear in one eye first or make more rapid progress there. This condition has occurred in patients with failing memory, mental and physical



Fig. 7 (Lloyd). Fundus of an elderly person with retinal reflexes, tortuous finer vessels in macular area and "meaty" choroid. After a slight head bump, the hole in the macula appeared.

deterioration usually called "softening of the brain." Similar macular defects occur in cases of cataract. If the lesions develop after the operation, the loss of central vision may precede the objective signs. If the defects are found after a successful cataract operation, the question may arise whether they are also present in the eye that has not been operated upon. The light-projection test will not decide this, but the patient must always be given the benefit of the doubt.

The original technique of perimetry was so tedious and the value of colored test objects so questionable that the natural preference for objective evidence led to relegation of the procedure.

Bjerrum introduced his system of quantitative perimetry and campimetry



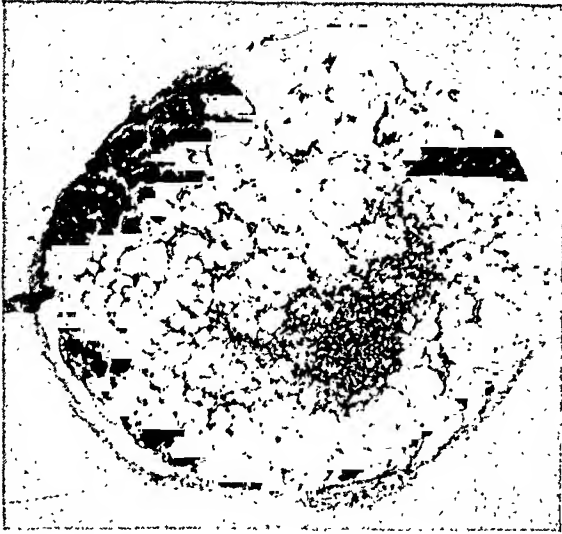


Fig. 8 (Lloyd). Patch of degeneration in optic nerve of an aged person (Fuchs. Arch. f. Ophth., 1920, v. 103. Ueber senile Veränderungen des Sehnervens).

placed glaucoma diagnosis upon a scientific basis and provided a practical technique for general use.

Perimetry is of greatest value in demonstrating and localizing lesions behind the globe. Lesions anterior to the optic thalamus have an effect upon the optic disc, but the farther back the lesion, the later does the atrophy appear. There are diseases along the optic pathways behind the globe which have no effect upon the disc but few of these belong to the group we are discussing.

Although the effects of entanglement of the chiasm under tension in the circle of Willis have been well studied in pituitary disease, this peculiar complication was more recently recognized in tumors of the brain with distention of the third ventricle pressing upon the chiasm from above.<sup>10</sup> Demonstration of local pathology in the optic nerves of older patients and the pernicious effects of pressure by sclerosed members of the circle of Willis was the work of Fuchs and Liebrecht.<sup>11, 12</sup> Fuchs examined the optic nerves and chiasms of a group of old persons and found amyloid deposits among the nerve bundles, patches of fibrosis in the nerves, and pressure damage at the inner margin

with serial white test objects in 1889, but some years passed before the idea reached us. The first Bjerrum scotoma reported in our ophthalmologic literature is the work of Dr. Harry Friedenwald in 1902. Dr. Luther Peter's campimeter imposed a practical demonstration that the field defects of glaucoma had been missed entirely because the profession insisted upon using the perimeter for purposes it could never satisfy. The Bjerrum method

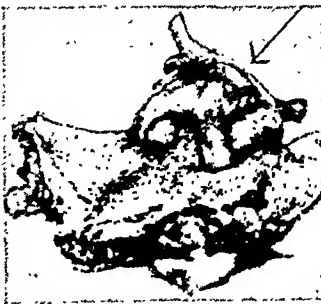


Fig. 9

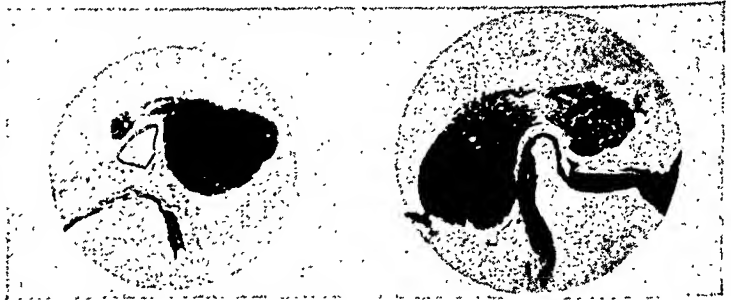


Fig. 10

Fig. 9 (Lloyd). Showing the optic nerves under pressure by ophthalmic arteries at entrance of optic foramen. Arrow points to anterior communicating artery which may indent the chiasm and damage the papillomacular bundle crossing (from Liebrecht. Sehnerv und Arteriosklerose. Arch. f. Augenh., 1902, v. 44).

Fig. 10. Left, temporal section of optic nerve damaged by pressure of ophthalmic artery. Right, optic nerve divided by pressure of rigid carotid and ophthalmic arteries (from Liebrecht. Arch. f. Augenh., 1902, v. 44).



of the optic foramen where the nerve was pressed against the fibrous margin of the canal entrance by the sclerosed ophthalmic artery. Liebrecht made extensive studies along the same lines and found the patchy degeneration in the nerves between the chiasm and the globe (figs. 9, 10). He also found the damage described by Fuchs at the entrance of the optic nerve into the optic canal, and advanced changes where the anterior cerebral artery and the ophthalmic artery, branching from the carotid, had indented the nerve near the chiasm. The one thing we lack is a systematic examination of such eyes in life as well as the pathologist's report. There are none of these available, so far as I know, and we are not in a position to say that a certain visual-field defect in an older person is caused by a certain patch of sclerosis in the macular bundle of an optic nerve or pressure of a sclerosed artery at a certain place in the

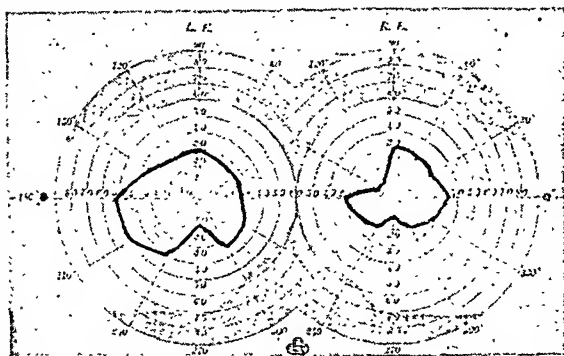


Fig. 11 (Lloyd). Vision with correction 15/30 and 15/20 despite very contracted fields. Fundus negative except the ordinary changes of vascular sclerosis in moderate degree.

cranium near the chiasm. Comparison of field defects in pituitary disease, chiasmal arachnoiditis, and brain tumors with those found in old people explain many cases formerly quite blank. Older people often complain of difficult vision but may read Snellen and Jaeger test type very satisfactorily. The fundus gives no clue

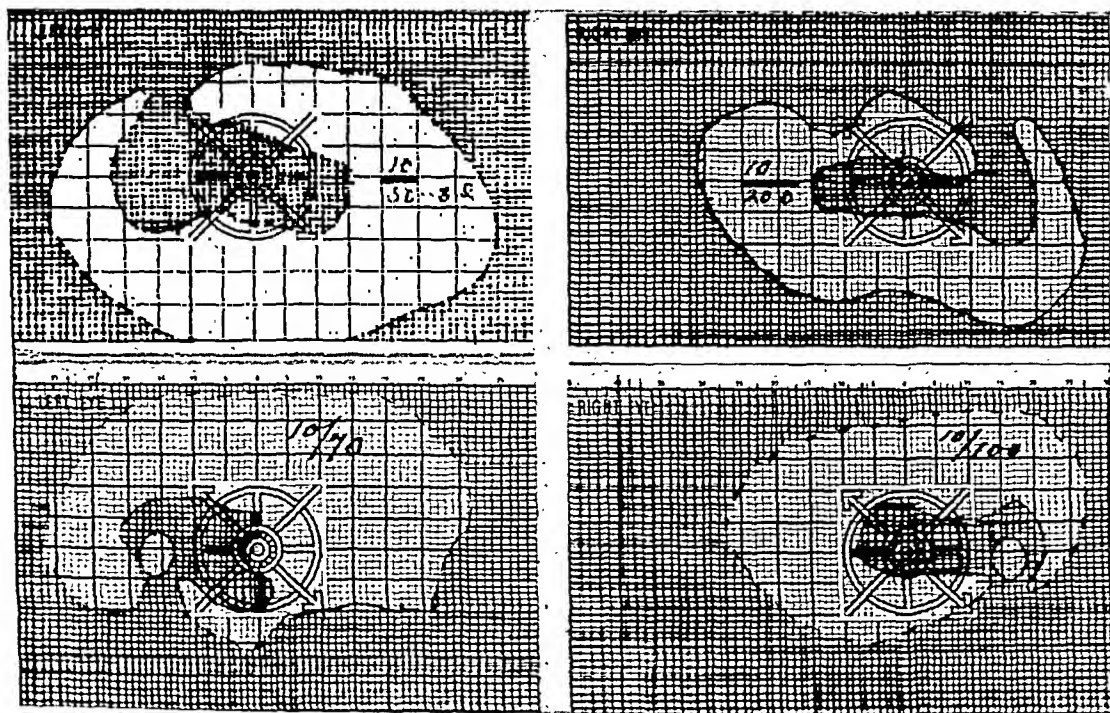


Fig. 12 (Lloyd). Contracted fields with central scotomas in older persons. Vision 10/50 and 10/200; 10/70 and 10/100.

whatever but the visual fields are very much contracted and the blind spots enlarged (figs. 11, 12). These patients are usually angiosclerotics and not infrequently are victims of vascular accidents

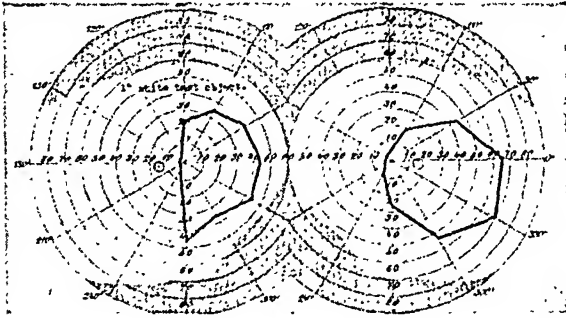


Fig. 13 (Lloyd). Left homonymous hemianopia came on during sleep without other complaints than difficult vision. O.U. 20/20 less a few letters with correction. One degree white test object.

later. Central vision may fail later and then, in addition to the contracted fields, there is a central scotoma extending from the blind spot to and including the fixating area, later to break through to the periphery, above or below the blind spot. The sclerosed ophthalmic artery pressing against the optic nerve may explain the constriction of the field, but the most reasonable explanation of the bilateral central scotoma is a patch of sclerosis in the center of each papillo-macular bundle. The cases with progressive atrophy of the nerve of one or both eyes would fall into the group of lesions caused by pressure of the carotid artery and its branches or to extensive degenerations extending up or down in both optic nerves.

Knapp<sup>13</sup> has discussed another phase of this condition with atrophy of the optic nerve, bizarre field defects, and cupping of the discs but without elevation of tension. This problem vexed von Graefe and Donders, who did not have reliable tonometers nor local anesthetics. When tension was evident to the fingers, it was called glaucoma simplex, but otherwise

it became cupping of the disc with amblyopia. Bjerrum demonstrated that careful field taking in many of these cases revealed the typical defects of glaucoma despite the low tension. Effort has been made to show sclerosis of the circle of Willis by the X ray, but the results are not satisfactory as yet.

Hemianopias caused by vascular accidents behind the thalamus have been studied in life and also in the laboratory. They have been consistently overlooked in practice since the practical Bjerrum technique came into use, because of the fixed idea that these defects are rare and cannot exist unless the patient has been seriously ill, or has lost much of his vision. Hemianopias due to lesions in the right optic radiation behind the thalamus can occur without loss of central vision, without illness, and with little inconvenience to the patient except that he cannot see well but does not know why. Any patient who has been in coma from whatever cause (uremia, apoplexia, sleeping sickness, difficult nitrous oxide anesthesia, or carbon-monoxide poisoning), especially an older person, may upon awakening complain vaguely of his vision, which should occasion a field study. The most common apoplexies concern the arteries of the internal and external capsule, but hemianopia is not a symptom of this anterior lesion. The most common hemianopias are due to lesions of the branches of the posterior cerebral artery. Lesions of the Sylvian artery may produce aphasia and disturbances of memory, but there will not be hemianopia unless the deep terminal branches are also involved. It is most desirable that we add to our clinical knowledge of lesions involving the optic radiation and its cortex; the greatest need, however, is to make our literature truly scientific by thorough study of the fields and vision of older patients in institutions where

autopsies are permitted and where there is an adequate staff of special examiners. At this time, all of our institutions lack sufficient help, but the return of peace may permit resumption of the many avocational activities of our medical men, of which the public knows nothing.

I would like to emphasize the statement that hemianopias are not uncommon,

that they occur without serious illness, and that the patient's complaints may be vague and seemingly unimportant. The vision may be 20/20, or nearly so, and any vascular incident, however insignificant, should suggest study of the visual fields.

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# CANCER OF THE EYELID\*

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## GENERAL CONSIDERATIONS

Cancer of the eyelid is a frequent disease. In a group of 2,601 patients suffering from cancer of the skin in one form or another and treated at the Pittsburgh Skin and Cancer Foundation, 239 had cancer of the eyelid. Thus, in an unselected group of patients suffering from skin cancer, cancer of the eyelid occurred in 9+ percent of instances.

Like tumefactions in any other location, cancer of the eyelid presents its own particular problems. These include that of diagnosis, of prognosis, and of therapeutic approach. It is the last-mentioned consideration, however, which most interests both patient and physician and affects the problems of diagnosis and prognostication.

The goal of treatment is the complete eradication of the new growth. This is to be accomplished in the shortest possible time, with the least amount of inconvenience to the patient, and with as little damage as possible to the eyeball, the tear ducts, and to the lids themselves, so as not to interfere with the ease, comfort, and function of all these structures. To take care of all of these contingencies it is of inestimable value that a variety of procedures is available for the purpose of complete destruction of a new growth.

These procedures include both surgical and nonsurgical methods. Surgical procedures consist of: 1. Ordinary excision.

2. Removal with the so-called radio-knife.
3. Destruction of the tumor by electro-desiccation or electrocoagulation.

The nonsurgical field offers: 1. A variety of modalities of X ray: a. Superficial. b. Contact. 2. Radium: a. Topical application. b. Insertion of emanation or radium needles.

## PURPOSE OF COMMUNICATION

The purpose of this communication is to discuss the methods of treatment and to endeavor to show both by illustration and statistical evaluation the irrefutable fact that it is not a particular method of treatment which determines the ultimate result, but that, in the final analysis, it is the adaptation of a procedure to the patient rather than the opposite which must be foremost in the mind of the physician.

In the accumulation of the material for this report only 125 of the 239 cases were finally chosen, chiefly because of incomplete histories and the absence of follow-up. Although this number is small, it serves to emphasize the previously stated therapeutic axiom.

## ANATOMIC CONSIDERATIONS

Delineation of the scope of the location of eyelid cancer was accomplished by the utilization of the fact that adipose tissue is not found ordinarily in eyelid structure.

Eyelids comprise the two thin movable folds of skin and mucous membrane in front of the eyeball and are placed there for such protection as they may offer

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\* From the Pittsburgh Skin and Cancer Foundation.

against injury, foreign bodies, light, and the like, this protection being accomplished by their closure. Eyelids are composed of the following structures: The skin, areolar tissue, fibers of the orbicularis oculi muscle, tarsus, tarsal glands, and the mucous membrane, the conjunctiva itself. The upper eyelids contain, in addition, the aponeurosis of the levator palpebrae superioris muscle. The skin covering the eyelids is very thin and extremely flexible. The junction with the mucous-membrane layer of the palpebral conjunctiva is more acute than are similar junctures at the vermilion border of the lips and about the mucocutaneous junction of the external genitalia and the anal orifice. However, this mucocutaneous "seam" of the eyelid does not seem to be as frequently the site of malignant cellular changes as are those in the other locations. Within the skin itself we find the usual appendages, sweat and sebaceous glands, hair follicles from which grow lanugo hairs, and also the short, thick outward-curving cilia. The subcutaneous tissue is referred to as being areolar. It is loosely and delicately constructed and, as previously stated, it does not ordinarily contain fat, and is thus used as definitive in determining the extent of the eyelids themselves.

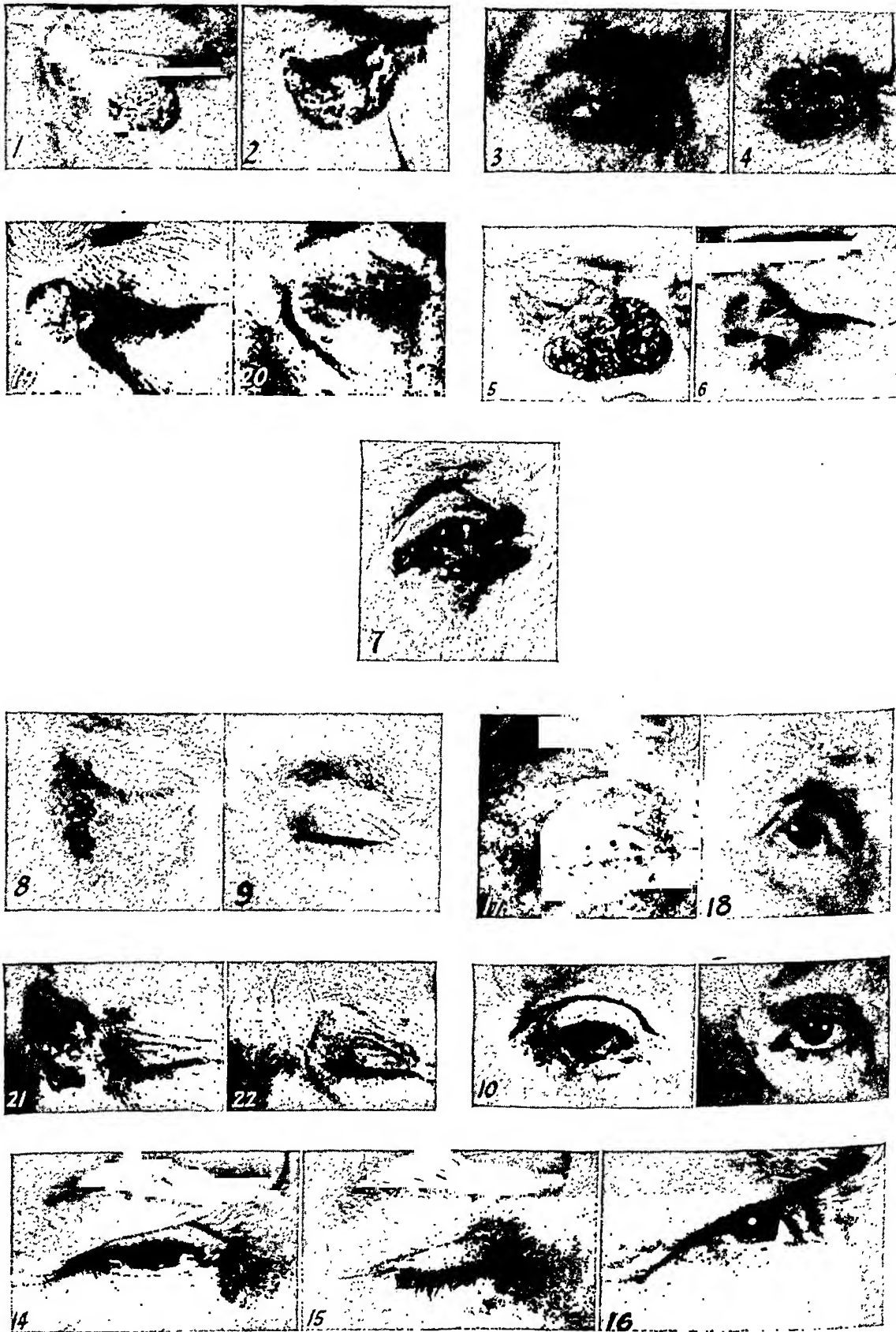
Likewise the palpebral commissures, both inner and outer canthi, are important delineating landmarks. Tumors located at the inner canthus, one of the most common sites of eyelid cancer, were found to extend over the side of the bridge of the nose rather than to extend toward the tarsal plate of the eyelid. Here again it was noted that the thin loose areolar skin without fat marked the scope of the rigid portion of the eyelid as it extended over the bridge of the nose. Thus, to recapitulate, cancer of the eyelid was considered as such when it was apparent that it arose from that portion

of the skin and mucous-membrane fold which contained no fat in the subcutaneous structures.

Cancer may occur at any portion of the eyelids, upper or lower, or at the inner or outer canthi. The distribution of cancers in the 125 patients under consideration was as follows: 17 on the upper eyelid, 47 on the lower eyelid, 52 at the inner canthus, and 9 at the outer canthus.

#### MORPHOLOGIC CONSIDERATIONS

The tumors varied considerably in their appearance. Some were but small nodules which protruded from an unaltered skin surface, enlarged very slowly, and could be recognized as cancers only by the fact that they were extremely hard. Some of the tumors were similar to those just described and varied only because of the atrophy of their covering epidermis. In some instances the normal skin tone was replaced by a waxy sheen which was soon recognized as being as pathognomonic as the stony hardness of carcinoma. In a number of instances the surface of the tumor was traversed by newly formed telangiectasia. Another type of tumor surface appeared studded by warty excrescences. In this type, usually because of the difficulty of removing the accumulated soiled epidermal debris, the lesion was discolored, grayish black, or it assumed a completely darkened appearance. In some of the tumors localized necrotic areas were predominant features. One or more small or large, deep or shallow, and usually uneven ulcerations were present, covered by a loosely glued various-colored encrustation. In the larger tumors, where localized cellular death had assumed larger proportions, the entire tumor area was at times destroyed, and the encrustation hid from view the base of the entire ulcer. Dependent on the amount of bleeding



Figs. 1-10, 13-22 (Hollander and Krugh). For Figs. 11, 12 and explanation of all figures, see next page.



Figs. 1 to 22 (Hollander and Krugh). Tumors of the eyelid.

Fig. 1. A fleshy carcinoma of the lower eyelid, showing warty excrescences on the surface.

Fig. 2. A somewhat rapidly growing carcinoma of the lower eyelid, deeply infiltrated, hair-matrix-cell type.

Fig. 3. A small epidermoid carcinoma of the upper eyelid. This tumor metastasized through the lymphatics and death resulted from this metastasis.

Fig. 4. An extensive hair-matrix type of carcinoma of the upper eyelid.

Fig. 5. An extensive epidermoid carcinoma which began at the inner canthus.

Fig. 6. A basal-cell type of carcinoma at the inner canthus which invaded the underlying structures and caused death by this extension.

Fig. 7. A deeply infiltrating epidermoid carcinoma of the outer canthus which caused death by extension.

Fig. 8. An extensive basal-cell type of carcinoma starting at the inner canthus and extending over the skin surface of the face, treated with 10 doses of superficial X ray.

Fig. 9. End result.

Fig. 10. Epidermoid carcinoma at the inner canthus and lower eyelid.

Fig. 11. Showing described eye shield in place.

Fig. 12. Showing contact X-ray-therapy machine in position (Chaoul tube).

Fig. 13. End result.

Fig. 14. Basal-cell type of carcinoma at the inner canthus.

Fig. 15. After 10 consecutive contact X-ray treatments, using the special eye shield.

Fig. 16. End result.

Fig. 17. Epidermoid carcinoma involving lower eyelid.

Fig. 18. After excision and surgical repair.

Fig. 19. Basal-cell type of carcinoma of the inner canthus.

Fig. 20. After surgical removal and pedicle-graft repair.

Fig. 21. Basal-cell carcinoma of the inner canthus extending over the nose.

Fig. 22. After surgical removal and pedicle graft repair.

that occurred through erosion of the superficial vessels, the color of the crust would vary. This encrustation, when it became heavy, would exfoliate of its own accord, expose the underlying ulcer bed, and then re-form as the drying effect of the atmosphere would concentrate suppurative, hemorrhagic, and necrotic material into a semisolid, loosely adhering but pliable surface cover. These processes of crust formation, exfoliation, and re-formation would follow each other at irregularly spaced intervals. Sometimes,

due to injury of some type or other or just because of the spreading necrotic process, minor hemorrhages would occur, and as they lasted shorter or longer periods the tinctorial effect on the overlying crusted structures would manifest itself in various degrees. Some of the tumors had a fleshy appearance, the surface being irregular because of retractions occurring at unexpected locations. In one instance a black-pigmented, shiny, flat nodule occurred about the center of the lower eyelid. The ominous black fore-



told the seriousness of the condition, for it proved to be an example of melanocarcinoma, the most dangerous and almost always fatal type of new growth.

### DIFFERENTIAL DIAGNOSIS

It is apparent from the perusal of the foregoing description that eyelid cancer has a multiform appearance, and clinical differentiation from tumefactions other than cancer is essential.

Pigmented hairy moles offer difficulty only from the standpoint of differentiating them from melanocarcinomas. One can depend on the admixture of brownish color and presence of the hair-bearing areas as points against malignant melanotic tumors. Especially the latter point, the presence of hairs over the surface of the tumor, is of inestimable value in this differential diagnosis. Melanocarcinomas, as a general rule, do not present such hair-bearing areas.

Vascular tumors, such as the ordinary variety of hemangiomas, may confuse the issue only until their composition of vascular structure is ascertained.

Small warty excrescences, the so-called filiform warts, occur with great frequency in older individuals. These little tumors are usually multiple and appear as pouchlike prolongations of various size. The important physical sign is the absence of hardness. It is supposed that they result from the loss of elasticity of the skin of the eyelids.

Yellowish and brownish flat multiple tumors are found in older individuals, whose forehead and face, as a general rule, are covered by these small tumefactions. These are examples of so-called seborrheic wart. Darker and somewhat harder nodules, the so-called senile keratoses, occur also and may be precursors of cancer of the eyelid.

Soft, yellow, oval, single or multiple tumefactions, the result of fat-cell deposits, are called xanthoma palpebrarum and are easily differentiated from cancer of the eyelid by the distinctive yellow color and the absence of the pathognomonic hardness of cancer.

Umbilicated, multiple, smaller or larger tumefactions of molluscum contagiosum may at times cause confusion. The rapidity of the growth and the spread, the presence of inflammation about the older lesions, the otherwise unaltered character of the adjoining skin surface, the absence of hardness, and the presence of itching will serve as differentiations.

Such tumefactions as that produced by chalazion or other chronic nodular localized inflammatory conditions will need thoughtful consideration from the standpoint of differential diagnosis. The most important one of these occurs as a small nodule at the margin of the eyelid and persists for a long period, remaining unaltered in size and unassociated with pain or tenderness. The firmness of the surrounding connective-tissue bands within which it is located endows the lesion with that nonelastic hardness which resembles the stony hardness of eyelid cancer. The microscopic picture presented by this type of tumefaction has been interpreted as a form of tuberculous reaction. We have encountered this lesion a good many times. Repeated guinea-pig inoculations, however, failed to prove it as caused by the tubercle bacillus. Thus, as the result of this negative bacteriologic finding, we have come to consider this eyelid tumefaction as an example of a foreign-body reaction, perhaps due to the inclusion of a broken hair shaft or some such substance within this area. We have no proof of this contention, but no other explanation seems as rational. We have found that this particular type of nodule can be

differentiated only by microscopic investigation.

#### MICROSCOPIC CLASSIFICATION

Whenever and wherever it is possible all of the tumefactions about eyelids should be studied with the microscope.

Classification of eyelid cancer according to microscopic appearance falls into four groups: (1) the basal-cell or hair-matrix type, (2) the squamous-cell or epidermoid type, (3) the mixed-cell type, and (4) the melanoma group. The importance of knowing the type of eyelid cancer under consideration is not only of academic value but has important connotations from the standpoint of prognosis. Parenthetically speaking, a completely removed basal or hair-matrix type of cancer should result in no further annoyance to the patient. Chances of recurrence should be practically nil. On the other hand, one may not be nearly so optimistic when one of the other three types of eyelid cancer has been discovered, for in spite of the greatest care and most meticulous elimination of these new growths, recurrences are not only possible but, in instances, even likely. This, of course, is especially true of the last group mentioned, the so-called malignant melanotic tumors.

Of the 125 eyelid cancers, 60 were classified according to their microscopic appearance. Of these, on the upper eyelid, 2 were basal celled and 4 were of the epidermoid-cell variety. On the lower eyelid, 16 were basal celled, 7 were epidermoid celled, 1 was mixed celled, and 1 was a melanoma. At the inner canthus 24 were basal celled and 2 were of the epidermoid-cell variety. At the outer canthus 3 were of the basal-cell type of carcinoma. Thus, of the 60 so analyzed, 45 were found to be of the basal-cell type, 13 were of the epidermoid-cell type, 1 was

of a mixed-cell type of carcinoma, and 1 was a melanoma.

It is indeed fortunate that the preponderance of eyelid cancers proved to be of the basal-cell or hair-matrix-cell variety. The proportion was 3 to 1. It is fortunate because this type of carcinoma is usually but locally malignant and lends itself readily to complete removal. This is especially true if it is treated early. Recurrences are due either to faulty removal or to the fact that the tumors have so invaded the surrounding structures that no therapy can accomplish the desired effect.

#### STATISTICAL CONSIDERATION

Of the 125 patients under consideration, 79 were men and 46 were women. Their ages ranged from 25 to 80 years. The seventh decade of life furnished 47 of the 125 patients, while 82 were found to be in the age group from 55 to 74, showing that the preponderance of the cases occurred in the aged patients.

The duration of these tumors was difficult to ascertain for several reasons: (1) Because patients, as a general rule, are forgetful, (2) because they are unobserving, (3) because these tumors were so inconsequential at times that they did not merit the fixation of the time of their first observation, and (4) because of the so frequently inherent optimism of patients, which tends to permit anatomic abnormalities to go unnoticed. However, we did find that 41 patients reported the duration of the lesion to be from one to two years, thus placing one third of these tumors in that particular duration bracket, which seems reasonable and worthy of acceptance.

One other observation is of importance. This concerns itself with multiplicity of lesions. While numerous cancers of the skin of the same individual

are not an infrequent finding, cancer affecting the eyelid was a single entity in all instances. We attach a good deal of importance to this fact.

### TREATMENT

The object of treatment, of course, is the complete eradication of the cancer present. This is to be accomplished with as little interference with function and with as little damage to the surrounding structures as possible.

**SURGICAL TREATMENT.** Whenever and wherever it is possible, cancer of the eyelids should be excised. This permits thorough microscopic examination, and invaluable information is gained as to the type of tumor and completeness of removal, both of which have, of course, a most important bearing on prognosis.

*Excision* is not possible if the tumor has invaded the surrounding structures to such an extent that the tumor cannot be freed and resected. Further difficulty with excision arises in the repair of the damage caused. Repair must be of such nature that the eyeball is not exposed unduly and that the eyelids are so reconstructed that their function is effectively maintained. When the entire thickness of the eyelid is involved in the neoplastic process, repair becomes difficult, but when the cancer is more superficial and freely movable, little difficulty is experienced because the loose and somewhat lax skin covering of the eyelids is easily shifted to cover the skin defects.

In carrying out surgical repair one must bear in mind at all times the following considerations: (1) that careful repair of the palpebral conjunctiva when it has been damaged is imperative; (2) that the proper support of the eyelids depends on properly reconstructed tarsal plates; (3) that eyelid-margin distortions

which could cause the inversion of the cilia are to be carefully avoided; and (4) that undue scarring is followed by retractions and the formation of an ectropion, and that this is also to be carefully avoided.

Repair of lesions excised from the region of the inner and the outer canthus offers fewer difficulties. This is due to the fact that although direct closures in many instances cannot be resorted to, pedicle grafts cut from adjoining skin surfaces are easily accomplished. These grafts can be obtained from the region of the glabella or the temporal area, depending on whether the damage is being repaired at the inner or the outer canthus, respectively. Our procedure in carrying this out is as follows:

An appropriately sized portion of skin is cut out, leaving a reasonably sized pedicle attaching it to the adjoining skin. The graft is transferred to the site of the excised area by a half twist of the pedicle. It is sutured into position by fine twisted silk and interrupted sutures and then bandaged in such a manner that pressure over the graft is maintained by means of a roller bandage of proper size. A wide elastic bandage is then wrapped about the head to insure the relative immobility of the dressing. One must be careful not to permit direct pressure to be applied to the eyeball; nor should the cilia be inverted during this procedure. A dressing of this type is kept in position for a period of five or six days, thus giving the graft an opportunity to adhere to the surfaces which have been uncovered by the operation.

Failures of takes from such pedicle grafts occur rarely, but when they do a variety of causes may be operative: These are as follows: (1) The pedicle is too narrow; (2) bleeding areas are not properly controlled, thus permitting an ac-

cumulation of hemorrhage under the graft which interferes with its adhesion; (3) the pressure applied is inadequate; (4) the dressing is removed before the fifth or sixth day. This last is exceedingly important. Sutures may be removed at the time of the first dressing, but the pedicle is permitted to remain for a period of at least three weeks. It is then easily removed and the final minor repair of the attachment is carried out.

Thirty-five of the 125 tumors were treated in this manner. Of these, 4 were of the upper eyelid, with 3 good results and 1 bad result; 16 were of the lower eyelid, with 13 good results and 3 bad results; 13 were of the inner canthus, with 12 good results and 1 bad result; 2 were of the outer canthus, both with good results. Thus, of the 35 surgical-scalpel excisions, 30 yielded good results and 5 bad results. Of the 5 bad results, 1, of the lower eyelid, was incompletely resected; 1, of the lower eyelid, yielded a malignant melanoma which terminated fatally; in 1, of the lower eyelid, the result could not be ascertained, for the patient failed to return; and 2, 1 of the upper eyelid and 1 of the lower eyelid, did not permit evaluation on account of the lack of sufficient time since operation.

*Radio-knife excision* followed by repair with pedicle grafting was carried out in 12 instances. It was a valuable method because it caused less hemorrhage and less shock and because it could be done quickly. Of the 12 patients thus treated, 2 had cancer of the upper eyelid, and both obtained good results. Six had cancer of the lower eyelids; we obtained good results in 4 and bad results in 2. Four patients had cancer of the inner canthus, in 3 of whom we obtained good results and in 1 a bad result. Thus, of these 12 patients, in 9 instances the results were good while in 3 instances they

were unsatisfactory. As the cancers treated by this method were extensive in size and considered not suitable for excision with scalpel, the high percentage of bad results is at least partially explained.

In another group of cases, in which the growth occurred at the inner canthus, excision with either scalpel or radio-knife surgery was not possible. In this group we found the cancer of the canthus to be of infiltrative character, and the tumors were firmly fixed to the fibrous structures of the surrounding area. The lesions themselves were immovable and firm. These patients were treated with *electrodesiccation*, unipolar diathermy being used for this purpose. After the tissues were thoroughly charred they were removed with a curette and the desiccated area painted with mercurochrome or, more recently, powdered with sulfathiazole and permitted to heal by granulation. Even after extensive electrodesiccation the scars obtained were highly satisfactory.

Such electrodesiccation was carried out in 13 cases. In the 1 instance of the upper eyelid a satisfactory result was obtained; of the 3 instances of the lower eyelid, only 2 satisfactory results were obtained; while of 8 instances at the inner canthus 4 satisfactory results were obtained; and in 1 instance of the outer canthus the result was unsatisfactory. Thus, of the 13 cases, 7 yielded good results while 6 yielded bad results. In the consideration of the high percentage of bad results, one must take into account the fact that only the inoperable type of cancer was subjected to this form of therapeutic approach.

In three instances the eyelid carcinoma was so extensive and so invasive that, in addition to electrocoagulation, enucleation of the eyeball was found imperative. One of these cancers occurred on the

lower eyelid, one at the inner canthus, and one at the outer canthus. None of these patients was helped by this treatment, and their disease resulted fatally.

**NONSURGICAL TREATMENT.** There were a number of reasons which prompted the use of methods other than surgical. These included the following: (1) The cancer was considered inoperable on account of its extension and size; (2) the patient was considered a poor operative risk; (3) the patient refused operation. In these instances X-ray irradiation was used in some form or other.

At first we used superficial unfiltered X ray, using lead foil as a shield both for the unaffected skin surfaces and over the eyeball itself. We experimented with a variety of doses from 350 r to 3,500 r in single or multiple treatments. After considerable trials we evolved a procedure which we use now and which we consider valuable. This procedure comprises the following steps:

An eye shield consisting of a soft lead-alloy material\* is used for eyeball protection. It has an inner smooth concave surface to fit the contour of the eyeball and an outer convex surface to which a small projection is attached for the purpose of handling it. This eye shield is sterilized by allowing it to remain in 70-percent alcohol for 10 minutes and then placing it in sterile water for 5 minutes to remove all traces of alcohol. Sterilized mineral oil is then dropped upon the concave surface to act as a lubricant. The shield is held by the tiny grasping projection and is inserted between the eyelids: one edge is gently but firmly placed under the upper lid; then by pulling down on the skin of the lower lid, the other edge is permitted to slip under the lower lid. Various sizes of these shields

are required on account of the variability of palpebral apertures. Patients seem to tolerate this shield much better than they do the lead foil which we used before we became acquainted with this later type of protection. After the shield is placed in position the unaffected skin is covered with lead foil or leaded rubber and the treatment with the X ray is begun.

Recently we have utilized the so-called contact X ray instead of the ordinary superficial modality. We have obtained this energy from a Chaoul type of tube which has a focal roentgen-ray skin distance of 3 to 5 cm., depending on the length of the applicator used. The Chaoul tube is so constructed that the cathode is located at the tip of a cylindrical projection over which the applicators are placed. Between the target and the lesion there is a thin filter, consisting of 0.5 mm. of nickel window, which is needed to confine the water that circulates about the cathode as a cooling agent. A variety of applicators is available. This type of irradiation provides intensive local reactions, but the depth of the reaction is relatively short. It is this factor that makes it ideal for use in eyelid carcinoma. Because the skin and areolar structures of eyelids are thin, the opposition to the passage of superficial X rays of the ordinary variety is ineffective, and the deeper structures may be damaged unnecessarily.

Daily treatments of 500 r each were given. These treatments ran from 10 to 20 in number, depending on the severity of the reaction produced. Usually after the sixth treatment a softening of the tumor and a beginning inflammatory reaction were noted. Following this there was a gradual flattening of the lesion, and over the tumor site a superficial yellowish moist ulceration developed which was surrounded by a reddened and swollen sharply demarcated inflammatory zone. When this occurred, usually between the

\* Supplied by V. Mueller & Co., Chicago, Illinois.

tenth and twentieth exposure, treatment was stopped. The reaction lasted from four to six weeks, then it subsided. Occasionally a course of treatments had to be repeated.

If the contact Chaoul tube for irradiation is not available, superficial X ray may be used. We have given 350 r with superficial X ray to carefully shielded areas in daily treatments until the development of a severe enough inflammation to conform somewhat to the type produced by the contact tube. Usually this requires about 10 consecutive daily treatments. As previously stated, both the depth and the width of the destructive reaction is greater with the ordinary superficial type of X-ray therapy.

Thirty-eight patients were treated with X ray. Of these, 17 were treated with the Chaoul contact modality. Of the 21 tumors treated with the ordinary superficial X ray, 6 were of the upper eyelid, 4 with good results and 2 with bad results; 6 were of the lower eyelid, 2 with good results and 4 with bad results; 7 were at the inner canthus, all with good results; 2 were at the outer canthus, 1 with good result and 1 with bad result. Thus, of the 21 patients so treated, in 14 instances good results and in 7 instances bad results were obtained.

Of the 17 tumors treated with the Chaoul contact type of X ray, 1 was of the upper eyelid, with a bad result; 5 were of the lower eyelid, all with good results; 8 were at the inner canthus, 6 with good results, 2 with bad results; 3 were at the outer canthus, 1 with good

results and 2 with bad results. Thus, of the 17 patients treated with the contact X ray, in 12 we obtained good results and in 5 bad results.

We treated but one patient with radium. His lesion was at the inner canthus. The result was unsatisfactory.

There were instances in which we had to use several methods of treatment—excision, electrodesiccation, roentgen ray, and radium. Various combinations of these procedures were used. In all, 23 tumors were so treated. Of these, 3 were of the upper eyelid, with 2 good results and 1 bad result; 10 were of the lower eyelid, with 7 good results and 3 bad results; 10 were at the inner canthus, 8 with good results and 2 with bad results. Thus, of the 23 patients treated with a combination method, we obtained good results in 17 and bad results in 6 cases.

Recapitulation shows that of the 125 patients, good results were obtained in 97 patients, unsatisfactory results in 28, for one reason or another. We further learned that no method yielded more satisfactory results than others and that the method of therapeutic approach depended on extent, operability, or the willingness of the patient to undergo certain procedures.

However, the general impression we gained was that the most satisfactory results were obtained from scalpel excisions or contact X ray, using the special shield which was described.

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# RECESSION OF THE INFERIOR-OBLIQUE MUSCLE FROM THE EXTERNAL-RECTUS APPROACH\*

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Overaction of the inferior-oblique muscle as a result of a paralysis of the homolateral superior-oblique muscle, or of the contralateral superior-rectus muscle, is not a common condition. Nevertheless, it may cause a hypertropia or ocular torticollis. When it causes these conditions and does not respond to treatment with prisms,<sup>1</sup> then surgical correction is necessary.<sup>†</sup>

This operation has been discussed by White,<sup>1, 2</sup> who believes that it is indicated for the following purposes: 1. To correct a secondary deviation (of the inferior oblique) caused by a paresis of the superior rectus of the fellow eye. 2. To correct the secondary contraction due to paralysis of the superior-oblique muscle of the same eye.

At the suggestion of Dr. Frederick A. Davis of Madison, Wisconsin, that a procedure for a recession of the inferior-oblique muscle be studied and systematized, the author for the last five years has compared the results secured by myectomy and tenotomy with the results obtained by recession of the overacting inferior oblique. The results of this study will be presented in a later paper. The technique and procedure, however, of the recession of the inferior oblique will be presented here.

The procedure for the recession of the inferior-oblique muscle from the external-rectus approach after being worked

out on the cadaver was then performed successfully on patients. The result obtained was a satisfactory reduction of the overacting of this muscle followed by reduction of the hypertropia and in most instances by decrease of torticollis.

Recession of the inferior oblique can be performed under either local or general anesthesia.

## PROCEDURE

*Step 1, Incision.* An 8-mm. vertical incision, 3 mm. from the external canthus, is made through the conjunctiva, but not through Tenon's capsule (drawing A). The longitudinal fibers of the external-rectus muscle can be seen through the vertically appearing tissue of Tenon's capsule over the muscle (drawing B).

*Step 2.* The incision is extended through the three layers of Tenon's capsule down to the external-rectus muscle. This muscle is dissected from the lateral bands of Tenon's capsule so that the strabismus hook can be inserted below it (drawing C).

*Step 3.* A suture is placed through its insertion as close to the sclera as is possible (drawing D).

*Step 4.* The external rectus is gently freed from the globe by nicking the central fibers of its insertion in the tissue between the sutures and the sclera, and by spreading the blades of the scissors. This method prevents cutting the sutures in the insertion and conserves the tissue. The external-rectus muscle when freed is gently pulled laterally and away from the globe (drawing E).

*Step 5.* While the bulb is rotated nasal-

\*From the Department of Ophthalmology, Children's Memorial Hospital. Presented before the Indianapolis Academy of Eye, Ear, Nose, and Throat, April 22, 1943.

†The nonsurgical treatment of the less severe of these insufficiencies will be presented in a later paper.



ly by fixation forceps grasping the stump of the insertion of the external rectus, a squint hook with its rounded point downward is gently inserted below the globe until its curved edge touches the floor of the orbit. This tissue which becomes engaged upon the forceps contains the inferior-oblique muscle imbedded in the fibrous connections joining it with the external rectus (drawings F and G).

*Step 6.* The inferior-oblique muscle is now freed from the inferior-rectus muscle as the former is gently pulled upon to expose it to view. This procedure depresses the posterior pole of the globe and elevates the anterior pole if the globe is held in adduction by the surgeon (drawing H). The fibrous connections between the external-rectus muscle and the inferior-oblique muscle are definite, thick bands (drawing H), as are similar connections between the inferior-oblique muscle and the inferior-rectus muscle (drawing I). These bands between the three muscles must be dissected free if a recession of the inferior-oblique muscle is to be done. (They should not be freed if a myectomy or tenotomy alone is contemplated or else a complete lack of function will result.) Meanwhile, a test is made to separate the action of the inferior-oblique muscle from that of the inferior-rectus muscle, as follows:

The rounded edge of a second squint hook is placed in the lower conjunctival sac to push the globe down and in as the pull on the hook below the inferior oblique is decreased (drawing G). Gradually the pressure on the hook in the lower cul-de-sac is released as the pull on the hook below the inferior oblique is gently increased. If the inferior oblique is on the hook isolated from the inferior rectus, the anterior pole of the eye will travel upward (drawing H). As the hook in the cul-de-sac is removed completely the gen-

tle traction on the hook below the inferior oblique is increased, and the anterior pole will travel upward to a fixed position. This test for the presence of the inferior oblique when positive will tell the surgeon that the inferior-rectus muscle is not on the hook and therefore prevent the surgeon from cutting the inferior-rectus muscle, which could easily be done were both engaged upon the strabismus hook. When this test discloses that only the oblique muscle is on the hook and after this muscle is freed from the fibrous bands seen in drawings G, H, and I, it is engaged between the blades of an advancement forceps in order to immobilize it (drawing J).

Sutures similar to those used in the Reese resection operation are inserted in the muscle central to the forceps, to prevent the retraction of its central freed end before it is sutured to the globe (drawing K). Similar sutures are placed in the peripheral end of the inferior-oblique muscle, the recession forceps are removed, and the cut ends are sutured to the globe. A space of 3 mm. between the two rows of sutures should be allowed (drawing K). No muscle tissue is removed. Following this tying of the sutures the globe is depressed downward for a few moments so that the tissue may as much as possible resume its preoperative relationship.

The external rectus, if it is not to be operated upon further, is reattached to its insertion by interrupted catgut sutures (drawing L). If a resection or an advancement of this muscle is contemplated, it can be done now. The conjunctiva is then closed by interrupted sutures (drawing M).

The advantages of recession of the inferior-oblique muscle from the external-rectus approach are:

1. A second (skin) incision is unneces-

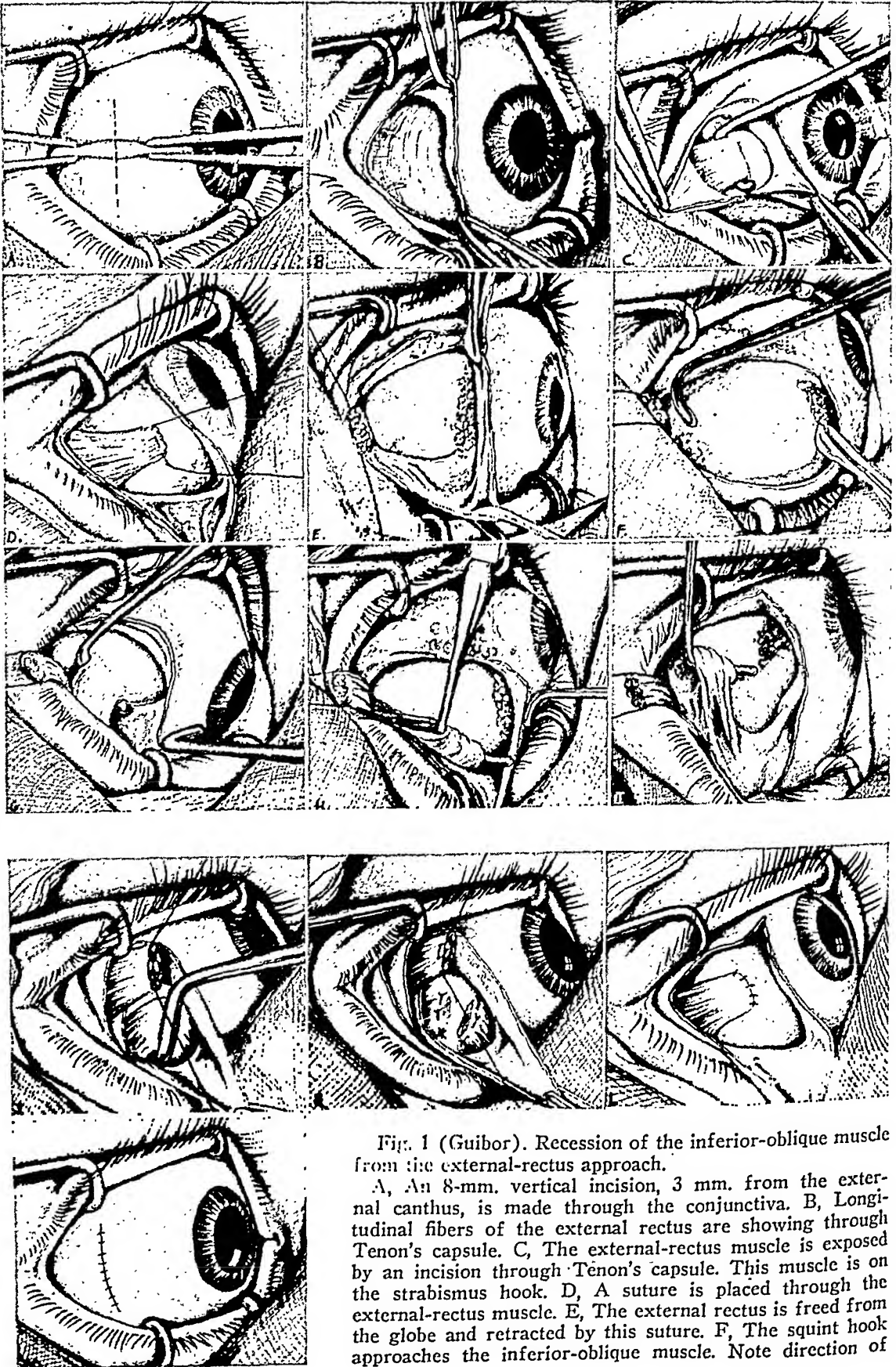


Fig. 1 (Guibor). Recession of the inferior-oblique muscle from the external-rectus approach.

A, An 8-mm. vertical incision, 3 mm. from the external canthus, is made through the conjunctiva. B, Longitudinal fibers of the external rectus are showing through Tenon's capsule. C, The external-rectus muscle is exposed by an incision through Tenon's capsule. This muscle is on the strabismus hook. D, A suture is placed through the external-rectus muscle. E, The external rectus is freed from the globe and retracted by this suture. F, The squint hook approaches the inferior-oblique muscle. Note direction of

sary because in most cases of squint the external rectus is operated upon anyway.

2. The field of operation is more accessible than in the other approaches to the inferior oblique.

3. There is little possibility of tenotomizing the inferior rectus if the test for the inferior-oblique action is made as described.

4. The results can be accurately foretold in most cases, and a recurrence of the overaction of the inferior oblique is unlikely to ensue.

5. Postoperative paralysis of the inferior oblique is less likely to occur than when a myectomy of this muscle is done.

#### SUMMARY

A procedure for recession of the inferior-oblique muscle from the external-rectus approach is suggested. Drawings

made from photographs of the operation are presented. These illustrate:

1. Incision through the conjunctiva.
2. Exposure of the external rectus.
3. Insertion of sutures in the external rectus.
4. Freeing and retraction of the external rectus.
5. Isolating the inferior oblique on the hook and identification of the muscle.
6. Freeing of the inferior-oblique muscle from the lateral-rectus and inferior-rectus muscles.
7. Grasping the inferior-oblique muscle with the recession forceps midway between the origin and insertion.
8. Insertion of the sutures in the inferior-oblique muscle, its section, and its reattachment to the globe.
9. Reattachment of the external-rectus muscle to the bulb.
10. Closure of the conjunctival incision.

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- <sup>2</sup> ———. *Ibid.*, *Arch. of Ophth.*, 1943, v. 29, p. 1033.

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hook, G, The tissue which is engaged upon the hook contains the inferior-oblique muscle imbedded in the fibrous connections joining it with the external-rectus and the inferior-rectus muscles. Note that the inferior oblique is not dissected from this tissue as yet. H, The fibrous connections between the external-rectus and the inferior-oblique muscles should be dissected free. Note fibrous bands between these two muscles. I, The fibrous bands between the inferior rectus and the inferior oblique are on the strabismus hook. These should be dissected free. J, After the inferior-oblique muscle is freed from its connections forceps are applied. K, The inferior-oblique muscle is bisected and the two free ends are reattached to the globe. L, The external rectus is reattached to the globe. M, The conjunctiva is closed by interrupted sutures.

# TRANSSCLERAL LACRIMAL-CANALICULUS TRANSPLANTS\*

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The fact that glaucoma is one of the common causes of blindness and one of the most difficult therapeutic problems encountered by ophthalmologists justifies further research in an attempt to control this destructive disease. In view of the limitations of present-day management of that group of clinical entities which we classify as glaucoma, we are looking forward to the day when an adequate medical regime will entirely replace the surgical treatment of glaucoma. Medical treatment has many obvious advantages over surgical treatment. It seems more rational, and is the type of treatment in which the prospects for successful future advances seem more likely. Until that day when the satisfactory medical treatment has been established, it is still necessary to rely on the surgical approach to this problem in both the clinical and the research fields.

Of the more satisfactory types of operative procedures for the control of ocular hypertension have been those operations which, in order to establish aqueous filtration, utilize uveal epithelium to form a permanent channel through the sclera from the anterior chamber to the subconjunctival tissues. While these types of operations are performed merely to secure symptomatic relief, it has been demonstrated that they are fairly effective in preserving vision in many eyes when performed at a sufficiently early date. In view of the technical disadvantages of all these accepted operations, it is with considerable hesitancy that an even more

complicated and technically difficult procedure is proposed, such as transscleral canaliculus transplants. However, this seemed an interesting field for surgical research, and consequently the following investigation was carried out.

## THE PROBLEMS

It is the purpose of this thesis to report a series of experiments which were performed with the immediate objective of investigating the various early steps in the establishment of an epithelial tube through the sclera with the ultimate hope of finding a type of filtration operation that might be an addition to our operative armamentarium in the control of glaucoma. Since an epithelial tract of iris tissue functions satisfactorily in some instances and fails in others, another source of epithelial tissue was sought which would have anatomic and physiologic advantages over the uveal tissue. The tubelike structure of the lacrimal canaliculus seemed to satisfy this requirement. If it could be satisfactorily grafted into the sclera, it might be utilized as a source of epithelial tubing for the establishment of a drainage canal from the anterior chamber through the sclera to the subconjunctival spaces. The six main problems which presented themselves were: (1) Could the canaliculus be satisfactorily dissected from the lids and freed of connective tissue? (2) Could it be placed into the sclera satisfactorily? (3) Could it be maintained in position? (4) If it were maintained there, would it be grafted and remain viable or would it become necrotic? (5) Would the eye tolerate this transplant? (6) If so, would it filter aqueous in the proper amount?

\*From the Department of Ophthalmology, Temple University Medical School. Candidate's thesis for membership accepted by the committee on Theses, American Ophthalmological Society, 1942.

## PROCEDURE

Problem 1 was solved relatively easily. In the spring of 1938 one eye of each of seven dogs was operated on. Under ether anesthesia the lacrimal punctum of dog 1A was dilated and a lacrimal probe was inserted. A circular incision was made through the conjunctiva around the punctum, about 1 mm. from the probe. Dissection was carried down into the tissue about 3 to 4 mm. on all sides of the probe. When this depth had been reached, the probe was withdrawn slightly and the canaliculus was cut transversely, leaving a collar of canaliculus about 3 mm. long around the probe. The specimen was trimmed of connective tissue, and a satisfactory segment of the lacrimal canaliculus was obtained for transplantation.

Problem 2 was the placing of the graft into the sclera. A keratome incision was made through the sclera into the anterior chamber, but it was found technically impossible to place the graft into the sclera, and the first eye was lost. This difficulty, however, suggested the necessity of inserting an obturator into the lumen of the canaliculus. Consequently, segments of metal lacrimal stylets, about 3 mm. long, were fashioned, and at the second operation the canaliculus was placed around the stylets quite satisfactorily. When the stylet containing the canaliculus was introduced into the keratome incision, the cornea was so displaced in dog 2A that it became obvious that some type of procedure that would remove part of the sclera was necessary to accommodate the graft. Since a keratome incision had been made, the eye of dog 2A was lost for further research. In the third experiment, which was performed on dog 3A, the canaliculus was prepared as previously described. A keratome incision was made in the sclera, about 2 mm. from the limbus. Then, with a

Berens scleral punch, a 1-mm. segment was taken from the anterior lip of the scleral incision. The graft with the metal obturator was inserted, and it fitted well into the scleral opening. The conjunctiva was closed over the metal obturator and the graft. Two days later the obturator had slipped out of position and the eye was lost. The fourth experiment, which was performed on dog 4A, was similar to the foregoing experiment, except that an L-shaped stylet was used in an attempt to keep the graft from slipping. This seemed to work somewhat better, but a severe incarceration of the iris occurred, which suggested the necessity of combining an iridectomy with the transplantation in order to prevent the development of an iris synechia. In the fifth experiment, on dog 5A, an angled stylet was introduced through the Berens punch wound after an iridectomy had been performed. On the third postoperative day the wound became infected and the transplant sloughed out. The same result was met with in the next two operations on dogs 6A and 7A. All the operations in series A were failures, and the conclusion was drawn that the stylet was too great a foreign body and proved an unsatisfactory obturator. None of the material from these experiments was adequate for microscopic study. The second step—namely, that of placing the transplant into the sclera—was not feasible, and the work was discontinued for two-and-one-half years, as the opportunity for further research was not available until the fall of 1941, at which time a second series of operations was performed. The animals in this series were termed B.

In September, 1941, this B series of operations was begun. Ten operations on nine eyes of six dogs were performed. It was recognized that a method to create intracanalicular pressure all along

the canaliculus when it was placed in the sclera was necessary. This problem was similar to that in skin grafting, in which one of the paramount requisites is uniform pressure over the graft; it differed from skin grafting, however, in that the pressure had to be applied to the 360 de-

accommodate the canaliculus graft. The canaliculus was then removed from the salt solution. A long no. 0 catgut suture was threaded through the canaliculus, and then turned around and passed back and forth through the canaliculus seven times until it was no longer possible to



↑  
CILARY PROCESS

Fig. 1 (Gibson). Dog 3, series B (left eye). Metal obturator. One week postoperative. Section shows canaliculus close to internal

←  
ANTERIOR  
CHAMBER

scleral surface, and the canaliculus epithelium is continuous with the epithelium of the anterior part of the ciliary processes.

grees of the internal circumference of the canaliculus. Since the metal obturator had apparently failed in the previous series of cases, the necessity for a softer and absorbable obturator was recognized, and catgut was selected as a possible material.

Accordingly, on September 15, 1941, dog 1 of series B was operated upon under intravenous veterinary nembutal, 4 c.c. being injected according to dosage for the body weight of the dog. The canaliculus was prepared according to the method described in Series A, and placed in physiologic salt solution. A large conjunctival flap was dissected, and a keratome incision was made 2 mm. from the limbus, and about 4 mm. long, passing into the anterior chamber. An iridectomy was performed. With a Berens scleral punch a 1-mm. button was removed from the anterior lip of the keratome incision to

pass further strands through the lumen. Close to each end of the canaliculus a loop of catgut was tied around the strands of catgut as they protruded from the lumen of the canaliculus, and both ends were securely tied. Next the strands which passed through the lumen were cut off close to the knots. Thus the implant consisted of a segment of canaliculus, about 3 mm. in length, through the lumen of which passed seven strands of catgut, which in turn were tightly tied at each end so that they formed a unified obturator. This implant was then inserted into the scleral opening made by the Berens punch. With a little manipulation it slipped snugly into the opening and seemed quite secure. The conjunctival flap was sutured back in place over the implant. The knot on the inner end of the implant could be seen in the anterior chamber, and the knot on the outer end



made a slight protrusion under the conjunctival flap. This solved problem 2; namely, whether the canaliculus could be satisfactorily placed in the sclera. On the third postoperative day the dog died an anesthetic death, never having regained consciousness. The eye was im-

exactly the same manner as was the right eye of dog 1B. The graft fitted snugly into the opening which had been prepared for it. The dog recovered from the anesthesia. Atropine was applied to the eye daily as it was in all subsequent experiments. One week later the eye was

Fig. 2 (Gibson). Dog 6, series B (right eye). Non-obturator technique. One week postoperative. Longitudinal section of canaliculus. The canaliculus is misdirected here, due to a technical error in operation.



mediately removed, placed in formalin, and sent to the pathology department for microscopic study.

The microscopic slides from this dog failed to show the operative field. Due to a technical error in the preparation of the sections no microscopic evidence of an operation having been performed was discernible. It is most probable that additional sections from this eye and others in which the operative field was not located would have been fruitful, but for technical reasons this was not done.

On September 22, 1941, dog 2 of series B was operated on in a similar manner, but before the operation was completed the dog died an anesthetic death. The operation was completed, but no study was made or conclusion drawn from this experiment, and there was no material for microscopic study.

On September 29, 1941, the right eye of dog 3 of series B was operated on in

examined and was found to be in excellent clinical condition. There was only slight conjunctival reaction, restricted to the operative field, such as one sees after a trephining operation. The cornea appeared to be normal. Two weeks later the reaction had almost completely subsided, and the catgut was not visible in the anterior chamber. Five weeks after the transplant this dog was again anesthetized with 5 c.c. of intravenous nembutal, and the conjunctival flap was again elevated in order that the operative field might be explored. The area of the canaliculus was located, and it was found to be covered with a very thin membrane of tissue on the external surface of the sclera. Gentle stroking of the membrane with a spatula caused it to rupture, and the aqueous was lost although the sclera was not opened. This suggested that the aqueous was coming through the canaliculus but was being retarded by this thin



membrane. The membrane was so thin that it seems probable that if the aqueous had been under pressure as in glaucoma, it would easily have permeated the membrane. This solved problem 3, showing that the canaliculus could be maintained in position. The conjunctival flap was then resutured.

Ten days later the eye was exam-

and the catgut was not visible in the anterior chamber. Three weeks after operation the eye was enucleated for microscopic study. Due to a technical error in the preparation of the sections, the field of operation was not visible in the microscopic specimens.

On October 13, 1941, the left eye of dog 5 of series B was operated on. The

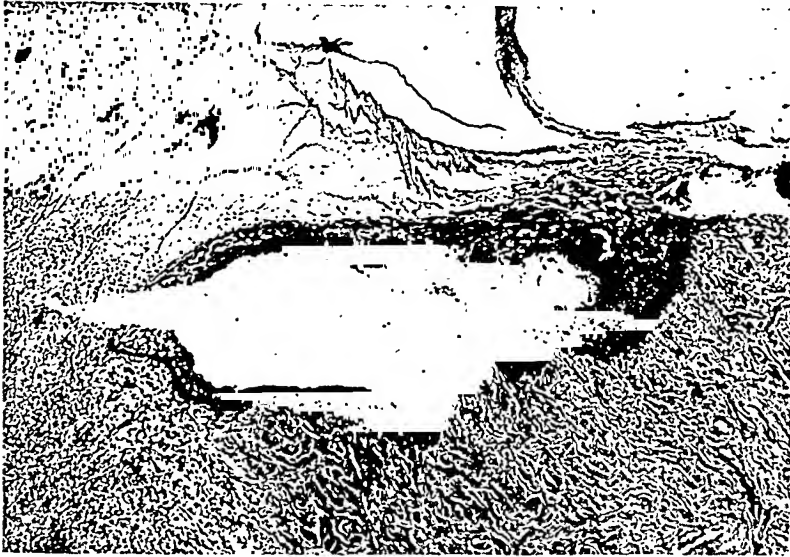


Fig. 3 (Gibson). Dog 3, series B (right eye). Catgut technique. Eight weeks post-operative. This section shows canaliculus growing half way through sclera. The large open white area is not the anterior chamber, but a deep tear made in the sclera in preparation. The smaller opening is only part of the lumen cut obliquely. The lumen remains patent after eight weeks.

ined, when the reaction was found to have subsided and the anterior chamber had formed. A hypodermic needle was introduced through the cornea into the anterior chamber, and sterile salt solution was forced in under pressure, through a syringe, to determine if the canal was patent, but no subconjunctival bulging over the area of the transplant could be demonstrated. One week later this eye was enucleated and sent to the laboratory for study. The pathologic material from this eye was properly located, and revealed the canaliculus with open lumen transplanted deep in the sclera.

On October 6, 1941, the left eye of dog 4 of series B was operated on in a similar manner. Eight strands of no. 0 catgut were drawn through the lumen of the canaliculus and placed in the sclera, as previously described. Ten days later the eye was in excellent clinical condition,

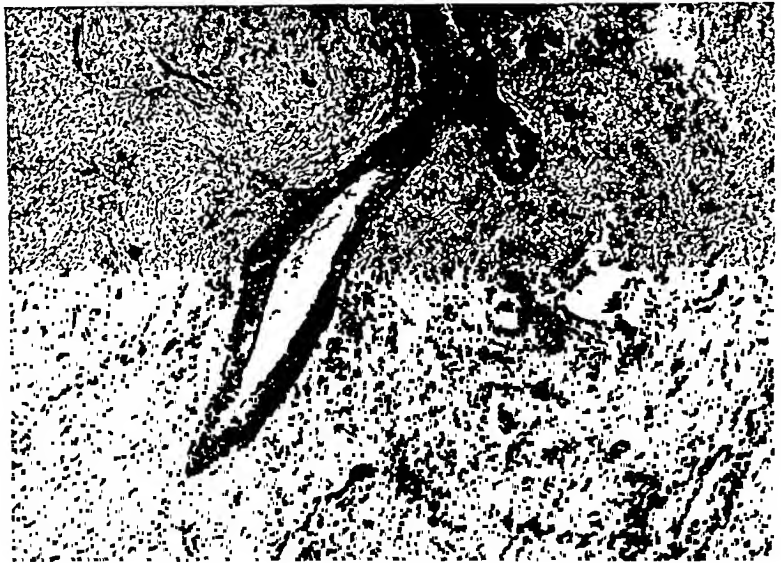
canaliculus was excised, a conjunctival flap was made, and a keratome incision was made 2 mm. behind the limbus. An iridectomy was done, and a scleral punch with the Berens instrument was made. Eight or nine strands of catgut were threaded through the canaliculus, and the transplant was inserted into the punch wound. It snapped firmly into position, and the inner knot was visible in the anterior chamber; the conjunctiva was closed with a single suture. Examination two weeks later revealed that the knot had absorbed from the anterior chamber; the eye was soft, and a large pool of subconjunctival aqueous was present. One week later, or three weeks after this operation, sterile salt solution was forced under pressure into the anterior chamber, but no evidence of fluid exchange from the anterior chamber to the subconjunctival space was demonstrated.

On December 1, 1941, in the absence of other experimental material, and since this same eye looked as good as though it had not been operated upon, it was decided to do a second canalizing operation of a different type on this same eye. A subconjunctival flap was dissected temporal to the area of the first operation. A keratome incision was made, and a second iridectomy was done. At this time

sclera down through the depth of the wound. Pressure was to be obtained by the tightly drawn sutures, thus firmly opposing the two margins of the wound. The conjunctiva was closed. Two weeks later, after the two operations, the eye was in excellent clinical condition and was enucleated for study.

The microscopic sections revealed the transplanted canaliculus. In one area the

Fig. 4 (Gibson). Dog 4, series B (right eye). Non-obturator technique. Two weeks postoperative. Canaliculus growing in center of sclera. The lumen is partly open and partly collapsed. This experiment shows that the transplant can be placed without an obturator, but the lumen remains open better in the catgut technique.



it was our impression that the previous technique had not been satisfactory, and another type of operation was performed. No catgut or metal obturator was employed and no Berens punch procedure was used. The canaliculus was sutured into the incision in the sclera. Two silk sutures were placed in the corneal margin of the incision and then passed through the side of the canaliculus without perforating the lumen; the sutures were then passed through the posterior part of the keratome incision, and the canaliculus, without an obturator, was inserted in the keratome incision. It fit snugly in place. The sutures were tied, and the canaliculus was in a very satisfactory position. It was hoped that the raw external surfaces of the canaliculus would graft to the surface of the incised

lumen was cut so as to show that it still contained degenerating catgut. The epithelial cells were partly necrotic in certain sections, and the graft, although present, did not appear to be so successful as it was in some of the others. In some sections a partial section of the epithelium could be seen growing quite normally. The area where the nonobturator technique was used was not positively located in the microscopic section.

On November 17, 1941, the left eye of dog 3 of series B was operated on. The flap, the incision, the iridectomy, and the Berens punch opening were all made in the routine manner. However, a metal (brass alloy) obturator, consisting of 3 mm. of a lacrimal stylet, was used. This stylet was fashioned so as to have two flanges on one end; these protruded lat-

erally about 1 mm. on each side, so that the obturator could not slip into the anterior chamber. The stylet was placed in the lumen of the canaliculus. It fitted snugly into the punch opening with the canaliculus. The conjunctiva was closed. Examination one week later revealed that

showed the opening of the canaliculus within the eyeball. The epithelium of the canaliculus could be seen growing over the internal margins of the scleral wound, and the epithelium of the canaliculus appeared to be growing over to join the epithelium of the ciliary body. While

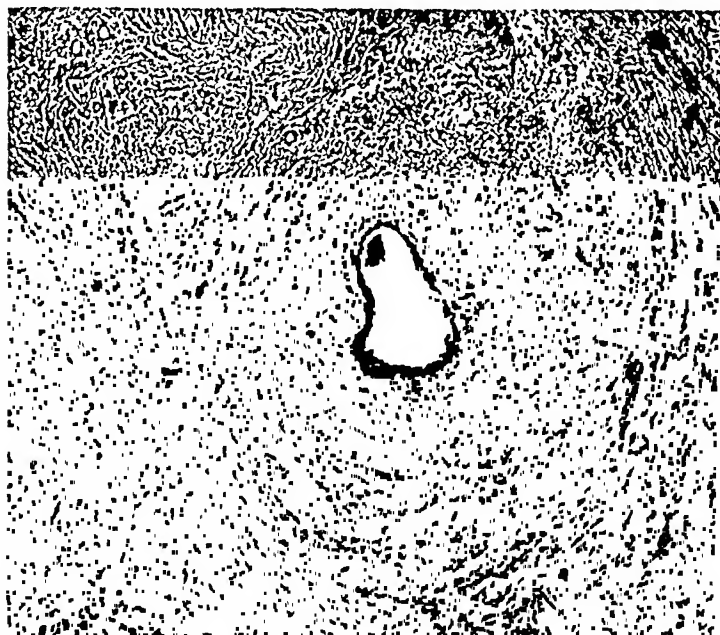


Fig. 5. (Gibson). Dog 5, series B (right eye). Catgut technique. Three weeks postoperative. Section shows fair growth of epithelium with some necrosis. Around the canaliculus there is a zone of tissue composed of new granulation tissue, new round cells, edema, some pericanalicular connective tissue, and some new and active blood vessels.

there was a severe reaction, that the cornea was very hazy in the upper third, and that the obturator had sloughed out of the place where it had been inserted and was almost ready to drop out of the eye. Salt solution injected into the anterior chamber did not come out under the conjunctiva, and one week after operation the eye was enucleated and sent for pathologic study.

The microscopic material from this eye consisted of 12 slides arranged in incomplete serial sections. The first five of these showed great thickening of the episcleral tissue due to young granulation-tissue proliferation combined with intense cellular infiltration and edema. The sixth slide showed the canaliculus grafted and viable in the sclera, with a somewhat mild cellular reaction around the canaliculus. In one section the transplanted epithelium

these sections do not reveal an undoubted opening, they do show that the epithelial graft takes all the way through the sclera, down to and continuous with the ciliary epithelium. Following along the sclera in the other sections, the healthy transplanted epithelial tubing can be followed all along the depth of the sclera to the surface. The epithelium averages about seven cells in thickness. The lumen is patent all along the tube; the surface of the epithelium is smooth, and the cells are viable. The basement membrane is intact, and adherent in its complete circumference in all the sections. This experiment answered problem 4, in that the graft would take and remain viable and not become necrotic. This and all the other eyes in this series B answered problem 5, that the dog's eyes would tolerate the operation.

On November 24, 1941, the right eye of dog 4 of series B was operated on. Two silk sutures were inserted in the anterior margin of the scleral incision, and passed one on either side of the resected canaliculus; then the sutures were put through the posterior margin of the scleral incision. The Berens punch was not used in this operation. The canaliculus was inserted into the scleral incision, so that one end extended into the anterior chamber and one end was left protruding under the conjunctiva. No metal nor catgut obturator was used in this experiment. There was very little reaction, and the eye was in excellent condition when, two weeks later, this eye was removed and sent for pathologic examination.

Examination of the serial sections from the right eye of dog 4B revealed that the area of operative interference was accurately located. In some of the sections it was possible to locate a portion of the transplanted canaliculus. The lumen was adequately open. The epithelium was intact, the cells were normal in appearance, and there were about 10 cells from lumen to basement membrane. The epithelium was neatly adherent to the sclera in its entire circumference and there was no evidence of operative activity in the sclera immediately adjacent to the canaliculus. There was slight infiltration of round cells, and there were quite a few more capillaries in the pericanalicular zone than are seen in normal sclera. Following the sections from the middle toward the external and internal surface of the sclera, it was found that the canaliculus became progressively smaller until, at either extremity, it appeared that the lumen of the canaliculus was almost obliterated.

About 2 or 3 mm. from the transplant there was a low-grade, well-circumscribed abscess that extended about half-way through the sclera. In its low-grade appearance this abscess resembled an early

tubercle. While it extended along the transplant, it did not involve the transplant. It appeared as if it would become absorbed. There were no clinical signs of inflammation.

Although this experiment was satisfactory from the standpoint of grafting, the canaliculus did not reach either surface of the sclera in the sections which we obtained.

On November 10, 1941, the right eye of dog 5 of series B was operated on. The steps of this operation were as follows: (1) The canaliculus was prepared. (2) A conjunctival flap was made. (3) A 3-mm. keratome incision was made and the Berens punch was used. (4) The opening in the conjunctival flap was sutured, as it was inadvertently button-holed. (5) Eleven strands of catgut were threaded through the canaliculus. (6) The Berens punch opening was twice enlarged, as the implant was larger than usual. (7) The implant fitted snugly in place, and the conjunctiva was closed.

Three weeks later the eye was in excellent condition, and it was enucleated and sent to the laboratory for microscopic study.

The microscopic report of the right eye of dog 5B revealed that the transplanted canaliculus was viable, with open lumen growing in the sclera. The lumen was completely open and contained a transudate and some fragments of catgut. The epithelial surface was relatively smooth, and appeared to be about five or six cells in depth. A few of the cells appeared to be sloughing off the surface. The basement membrane was in complete contact with the surrounding connective tissue from the lid, and this in turn was in close contact with the adjacent sclera in its entire circumference. There was excellent capillarity and evidence of circulation in the transplant all the way up to the epithelium. The scleral fibers coursing

around the transplant were normal except for the slight curving displacement caused by the transplant. In none of the sections was there any evidence of scar tissue due to the operation. The transplant gave the appearance of normal structure in its normal locus. Some of the sections showed areas where small fragments of the mucous membrane had sloughed away, and the cells appeared less viable than in some of the sections which were surrounded with less connective tissue. In this section neither of the ends of the canaliculus was located.

On December 8, 1941, the right eye of dog 6 of series B was operated on. The procedure in this case was the usual flap, iridectomy, and keratome incision. The incision was enlarged laterally with scissors, and an iridectomy was performed. The canaliculus was prepared and sutured in place in the sclera with two sutures, as previously described, but the position was not satisfactory. The wound was closed. Convalescence was uneventful, and one week later the eye was removed and sent to the laboratory for study.

The sections from this dog's eyes show an excellent "take" of the epithelial tube. The tube can be demonstrated to extend from one surface of the sclera to a point quite deep in the sclera. The section is cut so as to give a longitudinal section of the transplanted canaliculus. The lumen is well opened. In some of the sections the catgut sutures which were used in this case can be seen coursing into the margins of the canal. The epithelium, which is healthy in most places, can be followed for a considerable distance traversing the sclera. Due to difficulty in getting it properly inserted at the time of operation, the direction of the canal is not correct, but the graft is very successful and it can be seen to be growing into the surrounding sclera. Although the specimen is only one

week old, it is unquestionably growing quite solidly into the sclera along the entire course of the tube.

*Summary of procedure.* Seven eyes of seven dogs were operated on in series A. While the operations were all failures, invaluable lessons were learned and applied to advantage in series B.

In series B the operation was performed on nine eyes of six dogs. For various technical reasons four of these specimens were of no value. Of the remaining five eyes, which came to fairly satisfactory microscopic study, all showed evidence of success. In two the evidence of success was not marked. In three it seemed quite satisfactory. In none of the dogs' eyes was there clinical or microscopic evidence which suggested that an entirely patent channel had been established. However, our efforts in this regard were not so complete as they might have been.

#### DISCUSSION

The encouraging features of this experiment were: (1) The relative simplicity of the procedure. (2) The minimal clinical reaction and excellent postoperative appearance of all the eyes that had been operated on (exception: metal obturator case). (3) The success of the "take" of the graft. As the numerous microscopic slides were studied, one was constantly struck with the healthy appearance and completeness of the "take" of the epithelium. (4) The patency of the lumen. (5) The absence of untoward microscopic evidence of scleral reaction and scar formation.

The microscopic studies of the fate of the two ends of the canaliculus left something to be desired. This was partly due to the extreme difficulty of locating the ends of the tube in the microscopic studies. Problem 6—namely, Would the

canaliculus filter aqueous?—remained unanswered because we did not have chronic intraocular hypertension in the dogs' eyes and our attempts to force aqueous through the canal were somewhat incomplete.

### OBJECTIONS

There are many objections to this procedure, some of which are obvious and probably many others to which attention must be called. The first of these is the technical difficulty inherent in the preparation and the fit and maintenance of the graft. Such technical difficulties have been fairly well overcome.

Clinical difficulties may present themselves, such as the presence of hypotony, ectasia, phthisis, and late infection, which must be considered as possible pitfalls, and which, if they do occur, may be disastrous or may be overcome by modifications of the technique. None of these, however, was encountered in the dogs' eyes.

There are biologic objections that may be encountered clinically and that have to do with the activity of the epithelial cells in the anterior chamber. Unsettled are the problems of their growth, necrosis, obstruction, or opening of the ends of the tube.

Optical objections also are to be considered, such as refractive errors, and the effects on the lens and iris.

One of the most important objections is bacteriologic. Although it was gratifying to see that none of the eyes showed clinical signs of infection, and only one eye exhibited microscopic evidence of infection, yet the series is too small to warrant great enthusiasm in this regard. The procedure used in the operating room was designed merely to prevent the introduction of new organisms into the eye. Hands were scrubbed carefully, and the instruments received the usual preopera-

tive care. The eyes were merely irrigated with boric acid, and they were carefully draped as in routine eye surgery. The canaliculi, which obviously were contaminated, were not subjected to anything stronger than physiologic salt solution. This was done in order to determine if intraocular implant infection was likely to occur, and in series B this did not occur. These experiments were all terminated short of the time required for late infection, although one eye was followed uneventfully for eight weeks before it was removed.

### CLINICAL APPLICATION

All the well-known rules and limitations which are inherent in animal experimentation and their application to clinical cases unquestionably apply in these experiments. Due cognizance is taken of the probable undue enthusiasm following the partial success of these intrascleral-canalculus transplants in animals, and the improbability of ultimate clinical success in crossing the gap between animal experiment and clinical application.

### SIGNIFICANCE

After consideration of the more obvious objections and limitations, after the clinical observations on the dogs' eyes, and after studying the many microscopic slides in this experiment, the conclusion was reached that the procedure was sufficiently promising to warrant a clinical trial. Accordingly, a patient with glaucoma who had little vision to lose was selected for clinical trial.

### CASE REPORT

On May 15, 1939, F. D., aged 57 years, colored, came to the Temple University Hospital Eye Clinic for ocular treatment. He stated that one year previously he had had an operation on each eye performed elsewhere. His chief complaint was of



failing vision. There was no history of ocular pain. Examination revealed that his vision, with glasses, was 6/60 in each eye. The external appearance of the eyes was normal except for an iridectomy at the 12-o'clock position in each eye. The visual fields were concentrically contracted to less than 10 degrees. The ocular tension was 43 mm. Hg (Schiötz) in the right eye and 18 mm. in the left. The media were clear. Fundus examination revealed bilateral glaucomatous cupping of the disc. The diagnosis was advanced post-operative chronic simple glaucoma.

Since there was so little residual function of the optic nerve, further surgical treatment at that time was considered inadvisable. During the next two-and-one-half years various combinations and concentrations of pilocarpine, eserine, and epinephrine bitartrate were used. The tension, however, remained elevated all this time, regardless of which medication was used, and in spite of medical treatment there was a progressive loss of vision in each eye. In June, 1941, the patient's vision was O.D., light perception; O.S., 1/60. In December, 1941, vision in the right eye was nil and in the left eye it was 1/60. The tension in the left eye was usually between 36 and 57 mm. Hg.

Since the right eye was blind, and for over two years was known to have chronic hypertension, and because iridectomy had previously been performed, this eye was selected as ideal for experiment. Any reduction of tension which might result could not be attributed to the iridectomy. Furthermore, if this eye, which had so long been damaged, could tolerate the transplant, it seemed fair to conclude that the procedure might be applicable to eyes with much less advanced changes. On January 14, 1942, the right eye was operated on. At this time the intraocular pressure was 40 mm. Hg (Schiötz).

#### OPERATION

Under general anesthesia (sodium pentothal injected intravenously), 6 mm. of the upper right canaliculus was dissected from the upper lid and freed of connective tissue. It was then immersed in 1:500 metaphen for 10 minutes. A conjunctival flap was dissected. Next the canaliculus was dilated with a puncta dilator, at which time, due to overdistention, it was torn for about one-half its length. Five strands of no. 0 catgut were threaded through the lumen with considerable effort. A keratome incision 3 mm. long was made through the sclera, 2 mm. behind the limbus. The incision was enlarged laterally with scissors. A segment was punched from the anterior margin of the incision, but the obliquity of the incision prevented a complete punch wound from being made. The canaliculus was placed into the wound. The knot could be seen resting on the anterior lens capsule. This was owing to the fact that the canaliculus segment was too long. The conjunctiva was closed. Technically, it was much less difficult to perform this operation on the human eye than it had been to do so on the dogs' eyes.

#### POSTOPERATIVE COURSE

The first two postoperative days were uneventful. On the third day, due to pressure of the catgut knot, a round spot of corneal infiltration developed at the 12-o'clock position. On the fifth postoperative day a localized grayish exudate formed in the anterior chamber beneath the area of corneal infiltration, and this was continuous with the anterior lens capsule. On the sixth postoperative day there was a rather severe reaction, and a definite hypopyon formed in the lower part of the anterior chamber and lasted six days. It was doubtful if this repre-



sented actual intraocular infection or merely iris irritation. Sulfathiazole was administered by mouth on the third postoperative day, and on the fifth day, a course of typhoid vaccine was begun. These measures controlled the untoward effects of the operation. On the tenth postoperative day the tension was 0 and on the sixteenth day it was 3 mm. Hg. The reaction, while still fairly marked, was receding, the eye was comfortable, and the progress was quite satisfactory. There was a white mass of tissue at the external end of the transplant which seemed to be due to necrosis of the excessive amount of canaliculus outside the sclera. This mass of necrotic tissue was absorbed in about four days. On the eighteenth postoperative day the tension was 14 mm. On the twenty-fourth postoperative day the tension was 17 mm. There was a visible area of localized elevation of the conjunctiva similar to that seen after trephining. The reaction had subsided. The one untoward effect of the procedure was partial opacity in the upper fourth of the lens. It would appear that the graft was successful, and that the canaliculus was filtering aqueous in this case. It seems most probable, how-

ever, that the opening will eventually close.

#### PROGRESS NOTE

About six weeks after completion of this report the subconjunctival pool of aqueous on the patient's eye disappeared and the tension returned to its preoperative level. The operative field was explored, and it was found that the external end of the canaliculus was closed by subconjunctival scar tissue. A transscleral lacrimal transplant was subsequently performed on this man's other eye and this case will be reported later.

#### CONCLUSION

In this one case the eye was able to tolerate this operation, and at least a marked reduction in tension was produced during the first three weeks of the convalescence. Further clinical trial seems justifiable, and numerous technical improvements are to be made.

Although it is possible that there have been reports of previous canaliculus transplants, I am unaware of them. This work is still in the experimental stages, and we are not in position to recommend it as a clinical procedure.

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# TEST CHARTS REPRESENTING A VARIETY OF VISUAL TASKS\*

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To ophthalmologists and others engaged in examining eyes and in servicing them with corrective lenses, visual acuity is a very important visual function. Likewise, common test charts, consisting of "black" characters on a "white" background serve very well their specialized purpose. However, both visual acuity and the common test chart have often led eye specialists into misinterpretations and erroneous conclusions in connection with visual tasks encountered in everyday seeing. Common test charts of high brightness contrast between the test characters and their background fall far short of representing the countless critical visual tasks performed daily for long periods throughout civilized activities.<sup>1</sup>

The common test charts, and even more refined test objects, have been designed for determining visual acuity as specifically defined for a limiting condition. Certainly they were not intended for a more extensive purpose without appropriate considerations. Nevertheless, eye specialists have often misinterpreted and extended without justification the significance of determinations arising therefrom. For example, many statements have been made to the effect that visual acuity for so-called normal eyes reaches a maximum at about 10 foot-candles. At best this statement is incomplete and in a practical sense is meaningless. Sometimes such statements are extended to include defective eyes. In such cases it has been stated that for defective eyes to attain maximal visual acuity, the level of illumination must be greater than 10 foot-

candles or even as much as 100 foot-candles. Here again the statement assumes black objects on a white background, which obviously is a special case.

Much confusion has arisen from such statements chiefly because the conclusions are based upon typical test charts or test objects of maximal contrast between the (black) characters and their (white) background and ignore the fact that most visual tasks involve brightness contrasts far below maximal and reflection factors far below that of so-called white surfaces.

At this point it is essential to distinguish between foot-candles and brightness and to recognize the enormous influence of brightness contrast (between object and background) upon visual acuity. Brightness is a combined result of the reflection factor of a surface and of the foot-candles illuminating it. For example, a *foot-lambert* of brightness is produced by one *foot-candle* of illumination if the surface diffusely reflects *all* the incident light; that is, if the surface has a reflection factor of 100 percent. Some extremely pure white powders approach this value. So-called white papers have reflection factors of 75 to 85 percent. The diffuse reflection factors of most materials vary from those high values to a few percent for dark cloth or so-called black ink to less than 1 percent for black velvet.

It should be obvious that visual acuity as commonly defined is determined by an arbitrary set of conditions that cannot possibly be representative of the infinite variety of combinations of the factors involved. As commonly defined, visual acuity is the reciprocal of the threshold size of a critical detail; that is,

\* From the Lighting Research Laboratory, General Electric Company.

of the smallest size of a critical detail involving a "black" object on a "white" background. However, threshold size increases enormously as the brightness contrast decreases. Likewise the influence of level of illumination greatly increases as the brightness contrast decreases. Furthermore, the level of illumination necessary for distinguishing a critical detail of a given reflection factor increases as the reflection factor of the background decreases.

These relationships can be readily illustrated by measurements of "visual acuity" made with test charts on which the same characters are used but with different reflection factors of characters and backgrounds. The A.M.A. test chart was carefully photographed and prints were made with nonglossy photographic paper to exact size. By means of different ex-

posed had white backgrounds with a reflection factor of 82.5 percent. The reflection factor of the standard letters of the A.M.A. test chart varied from the usual "black" of chart 1 to a medium gray whose reflection factor was 65 percent in the case of chart 2, to a light gray whose reflection factor was 76.5 percent in the case of chart 3. It would aid in visualizing to note again in table 1 the difference between the reflection factor of the letters and that of the white background in each of these cases and also the effect of these differences upon brightness contrast. This effect is also shown by the following simple formulae.<sup>2</sup> When the surfaces of the background and of the letters diffusely reflect light and the test chart is uniformly illuminated, brightness contrast, expressed in percent, is equal to

$$100 \times \frac{\text{Brightness of background} - \text{Brightness of letters}}{\text{Brightness of background}}$$

posures of the print and of different degrees of "fogging" of the background a variety of test charts was readily produced. Four of these were selected for

In such a case diffuse reflection factor (DRF) may be substituted for brightness. Therefore, brightness contrast expressed in percent is equal to

$$100 \times \frac{\text{DRF of background} - \text{DRF of letters}}{\text{DRF of background}}$$

the present purpose and the descriptions and essential data are briefly presented in table 1.

It will be noted that charts 1, 2, and 3

In the less common case when the object is brighter than the background, background and object are interchanged in the foregoing formulae.

TABLE 1

DATA PERTAINING TO FOUR TEST CHARTS. REFLECTION FACTORS AND BRIGHTNESS CONTRASTS ARE EXPRESSED IN PERCENT. THE TEST CHARACTERS WERE IDENTICAL IN SIZE AND FORM ON ALL THE TEST CHARTS

Test Chart	Diffuse Reflection Factor		Brightness Contrast
	Background	Letters	
No. 1 Black letters on white background	82.5	2.8	96.5
No. 2 Medium-gray letters on white background	82.5	65.0	21.3
No. 3 Light-gray letters on white background	82.5	76.5	7.3
No. 4 Black letters on dark-gray background	3.3	2.6	21.1

Charts 1, 2, and 3 might be further visualized by placing strips of black, medium-gray, and light-gray papers, cloths, or threads on a white paper or cloth.

Chart 4 has a very dark-gray background, instead of a white one, and the letters are the usual "black." The brightness contrast between the letters and background is practically identical to that

rected to normal by means of eyeglasses. The charts were of standard size and were viewed at the standard distance of 20 feet.

The object of this paper is to illustrate certain principles that are commonly overlooked in interpreting measurements of visual acuity with the usual test charts into the much more complex realm of see-

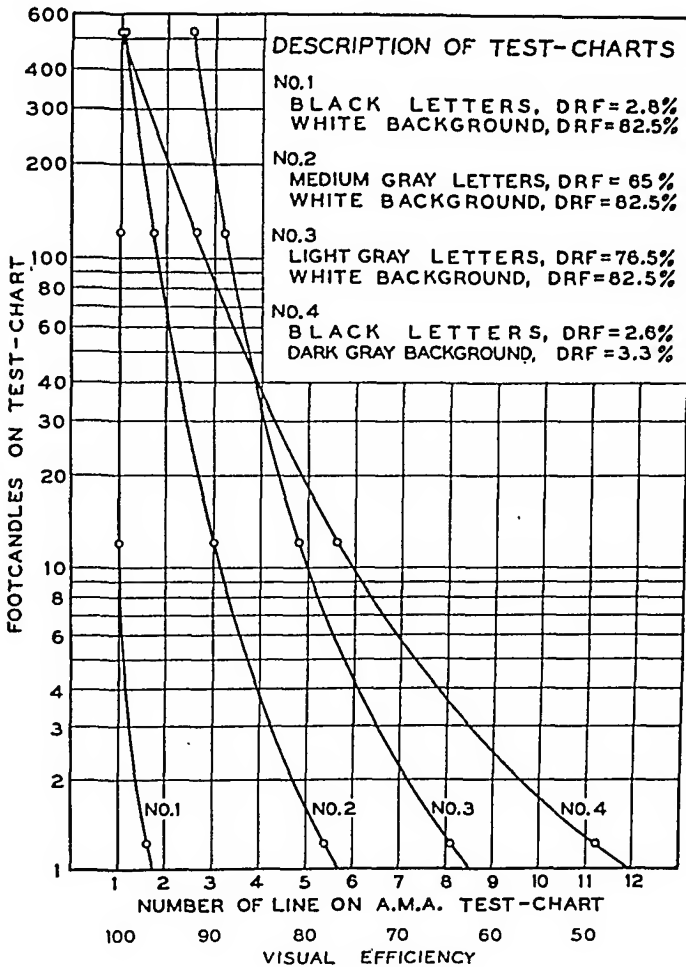


Fig. 1 (Luckiesh). Showing the level of illumination (foot-candles) necessary to make various lines on four different test charts barely readable at the standard distance of 20 feet. Chart no. 1 was the equivalent of the A.M.A. test chart. The other test charts are more representative of many visual tasks encountered in everyday seeing. The data represent the average from 20 subjects possessing so-called normal vision or corrected to normal by means of eyeglasses.

of chart 2. However, there is a great difference in brightness between charts 2 and 4 for the same level of illumination. In fact, to make these two charts identical as visual tasks, the level of illumination must be much greater on chart 4 than on chart 2. This is illustrated in figure 1, which is a plot of average results obtained with a group of 20 subjects possessing so-called normal vision or cor-

ing. Therefore, such a group of subjects is adequate for the purpose.

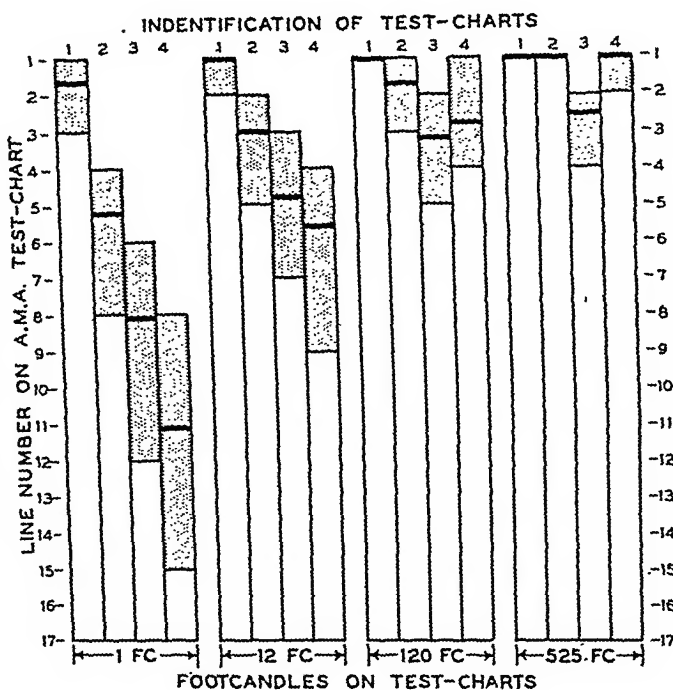
Various interesting facts are revealed by figure 1. It is seen that, on the average, line 3 of chart 4 was barely distinguishable under an illumination of 84 foot-candles. The same line on chart 2 could be barely read under an illumination of about 12 foot-candles.

On the standard chart 1; line 1 (repre-

presenting a visual efficiency of 100 percent by A.M.A. rating or 20/20 by Snellen rating) could be barely read under an illumination somewhat less than 10 foot-candles. However, on the average, line 1 on charts 2 and 4 could be barely read under an illumination of 525 foot-candles, or more than 50 times the level of illumination required in the case of the

jects. However, a more important point is that "visual acuity" in everyday seeing is greatly affected by reflection factor, brightness, and brightness contrast. In cases of very low reflection factors and very low brightness contrasts involved in many visual tasks, visual acuity, in a practical sense, does not reach a maximum until levels of illumination of hun-

Fig. 2 (Luckiesh). Data obtained with the four different test charts under four different levels of illumination. The shaded area represents the "spread" in each case among the 20 subjects possessing normal vision or corrected to normal with eyeglasses. The bold horizontal line in each shaded area represents the average line in each case which is barely readable by all subjects. The white area in each case represents the lines on each test chart which could be read by all subjects under each of the four levels of illumination, respectively.



standard chart 1. Line 1 on chart 3 could not be read under any level of illumination, even thousands of foot-candles.

The lessons taught by figure 1 should be obvious. Certain categorical statements or generalizations that have been made are indefensible and even ridiculous. The statement that visual acuity, determined by black characters on a white background, reaches a maximum at about 10 foot-candles is based upon the common black-on-white test chart. This is by no means true when determined by more refined devices, for visual acuity continues to increase up to and beyond 100 foot-candles for black-on-white test ob-

jects and even thousands of foot-candles are reached.

Imagine, for example, garment workers sewing with black thread on dark goods. The ordinary test chart, within its limitations, is suitable for determining refractive errors of their eyes, for prescribing certain corrections in eyeglasses, and for measuring visual efficiency in its limited fundamental sense. However, if the eye specialist is to extend his analyses to the task the garment workers perform and to comments on lighting and to specification of foot-candles, he is inadequately equipped with data. He would span a great portion of the gap if he used a test chart such as chart 4. Immediately he

would find that, on the average, under an illumination of 10 foot-candles, lines 1 to 6 on chart 4 are not readable as indicated in figure 1. From a practical viewpoint he might properly conclude that the average visual efficiency was 75 percent or vision was 20/50. He would also find that more light is the only practical aid available and would have to use higher levels of illumination if lines 1 to 6 are to be readable.

If the eye specialist carried the test far enough with this universally essential factor, he would find that 100 foot-candles increased "visual acuity" and "visual efficiency" for the garment worker engaged in his everyday tasks. He would also find that by increasing the level of illumination this worker would be progressively aided. Eventually he would reach several hundred foot-candles, such as are available at some windows or on some porches in the daytime. Continuing upward, he would reach 1,000 foot-candles and more. If the eye specialist were examining the group used in the present work he would find that on chart 4 he would have to have 525 foot-candles on the average for all the subjects to reach a "visual efficiency" of 100 percent.

In figure 2 are presented the "spreads" of the determinations made with these four test charts under four levels of illumination. It is emphasized that the 20 subjects had so-called normal vision or their vision had been corrected to normal with the use of eyeglasses. The shaded area in each case represents the spread for the 20 subjects, and the horizontal bold line in this shaded area represents the average of all subjects. Some of the subjects could read line 1 of the standard chart under 1 foot-candle and nearly all of them could do so under 12 foot-candles. The latter level of illumination produced a brightness of the white background on chart 1 (also on charts 2

and 3) of approximately 10 foot-lamberts. Under an illumination of 120 foot-candles, some of the subjects could read line 1 on chart 2, but only 10 percent of the subjects could read this line on chart 4. Under an illumination of 525 foot-candles, all could read line 1 on chart 2, none could read line 1 on chart 3, and only 70 percent of the subjects could barely read line 1 on chart 4. Actually, the illumination necessary to barely read line 1 on chart 4 varied from about 125 foot-candles for one subject to approximately 1,000 foot-candles for two subjects. Only 30 percent could read this line under a level of illumination of 525 foot-candles, which was the average "threshold" illumination for the entire group.

It should be noted that the diffuse reflection factor of the background of chart 4 being 3.3 percent, the brightness of this background when illuminated by 525 foot-candles is 0.033 times 525 or about 17 foot-lamberts. Only 21 foot-candles is necessary to produce this same brightness of the white background of chart 1. In addition to the need for 25 times more foot-candles to make the background of chart 4 equal in brightness to that of chart 1, still more light is necessary in the former case to make up for the relatively low brightness contrast. As a consequence, line 1 on chart 4 is only barely readable on the average under 525 foot-candles, whereas on chart 1 it is barely readable under somewhat less than 10 foot-candles for this group of subjects with so-called normal vision. Incidentally, from adequate knowledge of the visual characteristics of this group it is sufficiently representative for the purposes of this investigation.

Again imagine a group of garment workers sewing with black thread on dark cloth. The foregoing illumination values are for "barely seeing." No factor of safety is included for easier seeing. In addition, no allowance is made for old

eyes or defective eyes. No allowance is made for the fact that the percentage of ocular defectiveness is high among garment workers. Surveys have shown as high as 78 percent of garment workers have eye defects.<sup>3</sup> All these facts provide food for thought besides revealing the gross faultiness of statements carelessly made as to the adequacy of 10 or 20 foot-candles.

From the data presented one may consider numerous visual tasks. The choice of garment workers is of no particular significance. They were used merely to direct attention to a specific case. Illumination has been emphasized because there is no other means of increasing "visual acuity" and "visual efficiency" to a high level for the countless tasks not represented by black-on-white test charts. The eye specialist will do well to realize that his experience, tools, techniques, and interpretations in connection with his work on eyes and knowledge of vision have limitations when he considers the visual tasks in the world of seeing.

#### SUMMARY

The author has no quarrel with the test charts in common use nor with the overwhelming importance assigned to visual acuity for the eye specialist's use in his specific practice. However, visual acuity and the common black-on-white test charts have gross limitations when applied to everyday seeing.

Contrast sensitivity, or the ability to see differences in brightness, is a very important factor in seeing. At night, on the highway, for example, it far outweighs visual acuity in importance.<sup>4</sup> In everyday visual tasks at ordinary levels

of illumination, brightness contrast or the difference in brightness between an object and its background, has a very great influence upon threshold size, and therefore, upon visual acuity.

The literature contains many misinterpretations and erroneous statements pertaining to necessary or desirable levels of illumination, owing to the inadequate basis provided by considerations of visual acuity based upon black-on-white test charts and test objects. This has led to misunderstandings and in some cases to unfair as well as unsound attacks upon specifications of foot-candles. It is tempting to quote some of these statements which in the light of adequate knowledge are ridiculous. However, this would serve no essential purpose that the data in this paper do not adequately fulfill.

The visual tasks that are being performed by millions of persons for long hours daily are not represented even remotely by the common black-on-white test charts, which are examples of the easiest tasks of critical seeing. Test charts such as numbers 2, 3, and 4 are representative of many critical tasks of seeing, and the four charts at least span much of the range of everyday visual tasks. It is seen that levels of illumination of 100 to 1,000 foot-candles are necessary for barely seeing line 1, which represents a visual efficiency of 100 percent or 20/20 vision.

The author acknowledges the valuable work of A. A. Eastman, T. J. Borsch, G. P. Kerr, and T. Knowles in making and calibrating the test charts and in obtaining the data.

*Nela Park.*

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# NOTES, CASES, INSTRUMENTS

## A CASE OF ACUTE METASTATIC DACRYOADENITIS

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That acute dacryoadenitis is a rarity may be readily appreciated when one realizes that men like Arlt and Schirmer stated that they had never seen a case of



Fig. 1 (Rosen). Acute metastatic dacryoadenitis.

this disease in the acute phase. The recent excellent review of this condition by Richardson<sup>1</sup> suggested that it is so rare that all cases should be reported.

S. B., aged 20 years, was admitted as a patient at the Station Hospital on December 15, 1942, suffering from a mild acute, suppurative, nonvenereal penile lesion of undetermined cause. It was associated with an acute, right, inguinal lymphadenitis. The patient had noticed the penile lesion about three weeks prior to admission to the genito-urinary service and stated that he had been exposed one week earlier. Pertinent in his past history was the fact that he had had an attack of gonorrheal urethritis in 1940 and in 1941. He denied the existence of any previous penile lesion. The physical examination was negative except for "multiple irregular ulcers in the coronary sulcus on and around the frenulum, and a hard, painful 'bubo' in the right groin." Saline dressings and sulfathiazole 5 percent (powder)

were ordered for the penile lesion and sulfathiazole was given internally.

Three negative dark-field examinations were secured and negative Wassermann and Kahn tests were reported. The Frei test after 72 hours was reported as negative. On December 21, 1942, the urologic service made the following notation: "At the present this appears to be a non-specific lesion due to trauma incurred at the time of intercourse."

On December 20, 1942, the right eye became red, edematous, and swollen. The involvement was suspected of being an early conjunctivitis and was treated accordingly. The eye continued slowly to become worse notwithstanding frequent boric-acid applications, and it was noted that the condition appeared much worse in the 24 hours just prior to the requested ophthalmologic consultation.

The patient recalled that during the attack of "gonorrhea" in 1941 he had had a similar involvement of his right eye, it having been inflamed, red, tender, and swollen at its lateral aspect. He had received no medication for this ocular condition, yet these symptoms disappeared in 8 or 10 days. He did not recall that any secretion had been present and did not believe that there was any degree of pain at any time during the course of the ocular disturbance.

On December 26, 1942, the patient was referred to the eye clinic because of the increase in pain, tearing, redness, and secretion in the right eye. The eye and lid had become tense and painful in the upper temporal portion. Upon this initial examination the outstanding features included a peculiar violaceous congestion of the temporal half of the bulbar conjunctiva of the right eye together with an edema of the outer third of the upper lid,

producing a characteristic *italic letter-s curve* with the long axis of the "s" in a horizontal meridian. When the temporal third of the lid was raised upward, a mild chemosis of the palpebral conjunctiva was evident. This had not extended to the bulbar conjunctiva. As the lid was pulled up the lacrimal gland readily prolapsed into view. It was extremely injected, thickened, cyanotic, and glassy in appearance (fig. 1). In extent it ran well on toward the center of the lid, gradually tapering as it continued in this direction. When the examiner's index finger was placed along the lateral portion of the external orbital margin it was quite evident that the normal sharp edge of this area had become rounded off by a more or less firm swelling. This area was not extremely tender, although eversion of the lid produced excessive pain. Many subconjunctival hemorrhages were present in the upper outer portion of the bulbar conjunctiva.

In 24 hours the acute dacryoadenitis had become progressively worse and now involved the orbital as well as the palpebral portion of the lacrimal gland. This gland showed an increased tenderness and a brawny induration and it prolapsed into the cul-de-sac. The right eye showed some exophthalmos. In looking to the right and up diplopia occurred, due to restricted motion of the eye in this direction. The upper temporal quadrant was the area most involved, but some of the congestion had now spread to the lower temporal bulbar conjunctiva. There was slight preauricular adenitis along with temperature elevation of 1.5 degrees. Smears and cultures of conjunctival secretion, blood count, blood chemistry, and sedimentation rate revealed no significant findings. The urine specimen showed many white blood cells.

This acute phase persisted for three days without any improvement, and a bi-

opsy was contemplated for diagnostic purposes. On December 29th, there was definite improvement for the first time, the gland having become smaller and the congestion appearing less intense. On December 31, 1942, it was noted that the gland was rapidly shrinking and that there was evidence of fluid substance in the gland, which now resembled a large sac. The normal sharp border of the supraorbital margin had returned, and the intense violaceous congestion had begun to disappear.

On January 3, 1943, the eye showed a great improvement, very little swelling, redness, and pain being present. The penile and glandular lesions had all healed by this time, and the patient was discharged from the Hospital on January 7, 1943. Daily conjunctival smears failed to show any gonococci. No acute conjunctivitis was present at any time and the lacrimal gland was not involved by any direct extension. At no time was there any involvement of the cornea, anterior chamber, iris, lens, vitreous, or retina. The diplopia when the eyes were up and right was present for a period of four days only. The vision in each eye was 20/20 and remained so throughout the period of observation. The originally described conjunctival hemorrhagic areas were completely absorbed at the end of two weeks, at which time most of the redness and swelling had disappeared.

It is interesting to note that in Richardson's case there were repeated negative cultures and smears for gonococci, but when a complement fixation test was performed the reaction was reported as positive. This, however, could not be performed in the present case. It has also been pointed out that this condition shows a tendency toward recurrence. Although no positive etiologic factor was ascertained and although gonorrhea was not established as the cause of this complica-

tion it is well known that the condition involving the lacrimal gland may arise from a source where the organism has remained dormant, such as in the very vascular portion of the prostate. This would appear to be particularly true in cases where a previous urethritis had existed and had not been treated adequately. The

fact that in this case there is evidence of recurrence of the dacryoadenitis and that a similar previous attack had occurred during an acute urethritis would strongly make one suspect a related etiologic factor.

*Station Hospital.*

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### CONGENITAL CYST OF THE OPTIC NERVE\*

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Miss B. K., aged 19 years, appeared at Dr. Bernard Samuels's Clinic at the New York Eye and Ear Infirmary on December 3, 1942. She was apparently a normal, healthy individual, of average size and intelligence. She complained of slight symptoms of eyestrain.

Her vision was 20/20 in the right eye and 20/20 in the left eye. There was no external abnormality and no muscle imbalance. Her refractive error was, O.D. -0.25D.sph.  $\approx$  +0.50D. cyl. ax. 180°; O.S. +0.50D. cyl. ax. 180°.

The fundus of the left eye was perfectly normal. That of the right eye, however, showed a cystic mass  $1\frac{1}{2}$  discs in diameter, extending from the limit of the upper third of the disc down and out below the disc. This cyst was somewhat oval in shape with 6D. elevation, and was moderately translucent. The surface of the cyst wall was covered by small blood vessels. The retinal vessels behind the cyst appeared to be normal,

entirely unaffected by the presence of the cyst (plate 3, fig. 1). The blind spot of the left eye was normal, as was also the visual field. The blind spot of the right eye was four times larger than normal, and the visual field was definitely cut on the temporal side to 55 degrees for a 3-mm. white test object on the perimeter (fig. 2).

The family history was negative except for the fact that the mother had a right convergent squint. Her fundus was normal. A brother, aged 10 years, also showed a normal fundus.

In February, 1943, I saw another patient, a boy, S. B., aged 16 years, whose fundus disclosed a flat connective-tissue cystic area similar to the one reported, over the disc of the left eye. This area did not appear quite so definitely cystic. I have not as yet obtained a photograph of the fundus.

The embryonal hyaloid canal, known as the canal of Cloquet, is the basis for many anomalous pictures.

These were well classified by DeBeck<sup>1</sup> in 1890. His classification refers to 12 different phases. These are as follows: 1. Shred of tissue on the optic nerve. 2. Membrane on the disc. 3. Cystic remains on the disc. 4. Massive connective tissue on the disc. 5. Rudimentary strand at-

\* Presented at the meeting of the Ophthalmologic Section of the New York Academy of Medicine, May 17, 1943.

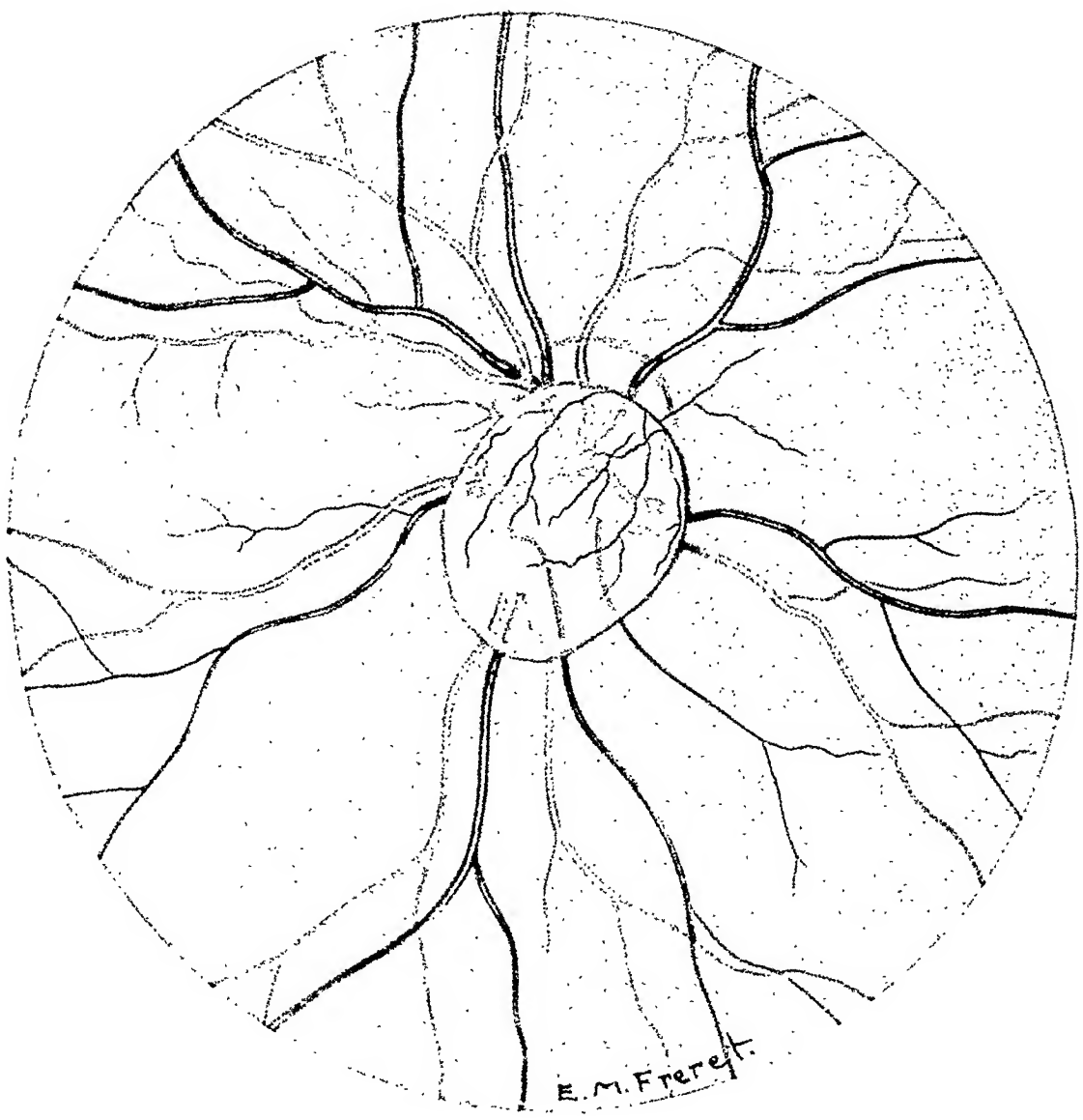


FIG. 1 (AGATSTON). CONGENITAL CYST OF THE OPTIC NERVE



tached to the disc. 6. Strand on the disc and posterior capsule of the lens. 7. Strand from the disc to the lens. 8. Similar strand containing blood. 9. Strand

In 1906, Parsons<sup>3</sup> in his "Pathology of the eye," mentions a case which showed a large blindspot but no contraction of the visual field.

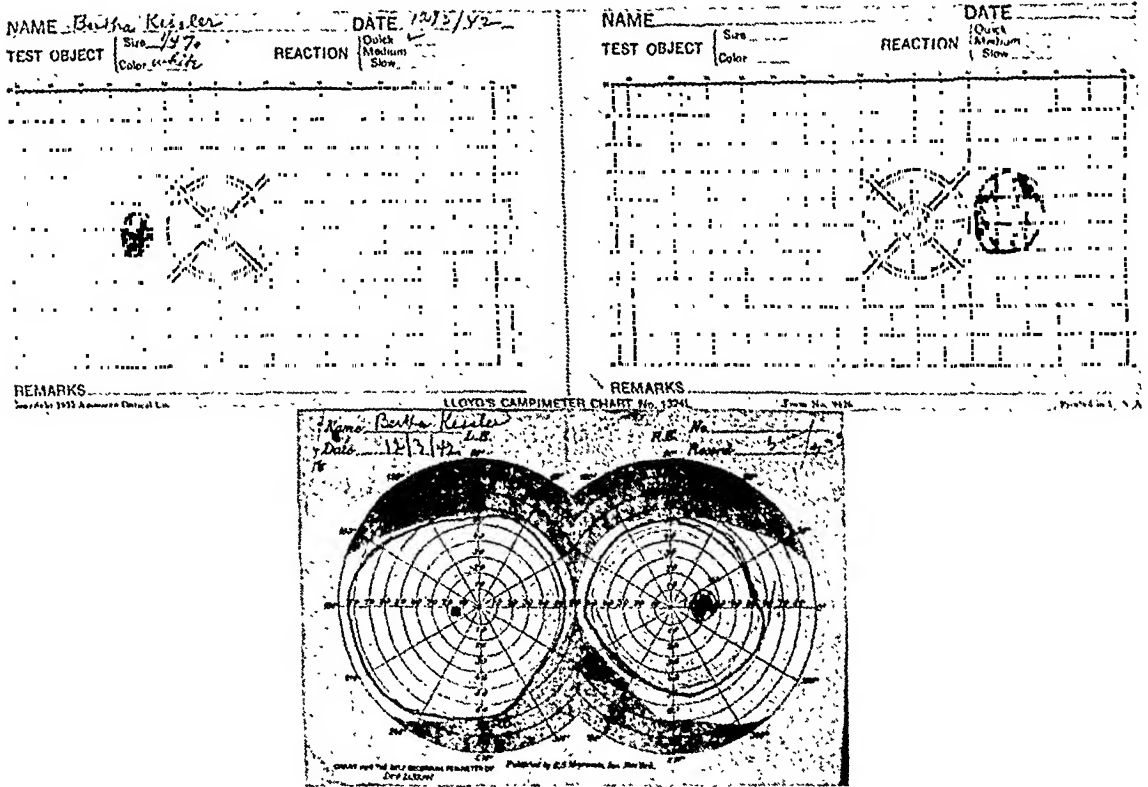


Fig. 2 (Agatston). Visual fields in a case of congenital cyst of the optic nerve.

attached to the lens alone. 10. Posterior capsular cataract. 11. Striae on the posterior lens capsule. 12. Persistent canal, without remnant of the vessels.

This is a quite comprehensive list although many other familiar variations are seen.

Cystic prepapillary remains have also been reported by Randall<sup>2</sup> in 1888.

Hunter W. Scarlett<sup>4</sup> reported a case in 1922, and Yudkin<sup>5</sup> reported one in 1926.

In 1939, Levitt and Lloyd<sup>6</sup> reported a prepapillary cyst, containing a moving vascular loop. The blindspot was markedly enlarged and the visual field was also somewhat contracted.

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## A RATIONAL BASIS FOR CROSS-CYLINDER TESTS

JOSEPH I. PASCAL, M.D.

*New York*

The how and why of cross-cylinder tests can be more easily understood by a study of the diffusion spots that make up the retinal image in an astigmatic eye than in any other way. It can be shown that when the astigmatism is changed to equally mixed astigmatism, the effect of flipping the cross cylinder is to change the *size* of the retinal diffusion spots without changing their *form*. Images made up of larger or smaller diffusion spots of the same *shape* can be easily compared as to clearness, the image made up of smaller diffusion spots naturally being the clearer.

To clarify the basis of the procedure it would be well to redefine a few of the terms used. "Fogging" means to make an eye myopic by means of a plus sphere if it was not "fogged" or myopic to start with. In the presence of astigmatism, simple or compound, "full fogging" means making both principal meridians myopic. "Half fogging" means making one principal meridian emmetropic, the other myopic. "Unfogging" may be used to mean leaving the examined eye hyperopic or making it so by means of minus spheres. In the presence of astigmatism, simple or compound, "full unfogging" implies both meridians being hyperopic, "half unfogging" implies that one meridian has been made emmetropic, the other hyperopic. "Meridionally balanced" or simply "balanced" means that, where astigmatism is present, one meridian has been made myopic, the other hyperopic; in other words, the astigmatism has been changed to mixed astigmatism.

Using these terms in the sense outlined we can say that cross-cylinder tests made while the examined eye is "fogged"

(fully or half), or "unfogged" (fully or half) are difficult, often unreliable, and sometimes even misleading. But if the tests are made after the eye has been "balanced," as nearly as possible evenly balanced—that is, as strongly hyperopic in one meridian as it is myopic in the other—then the tests are more effective, more definite, and free from misleading clues. The reason for this is that only when the eye is balanced, do the two positions of the cross cylinder produce diffusion spots that are readily comparable. These spots are diffusion *circles* (in a physiologic not a geometric sense) of *different sizes*. Whereas when cross-cylinder tests are made on an eye that has not been previously "balanced" the diffusion spots resulting from the two positions of the cross cylinder differ in *size* and *shape*, leading to difficulties in comparison and sometimes even to misinterpretation. I think even Dr. Crisp's new ingenious test for axis described in this Journal for June, 1943, would work more smoothly if the eye or photographic camera was first balanced rather than half-fogged.

Possibly the long-delayed realization of this cardinal principle in cross-cylinder tests was due to the way the imperfect focusing in an astigmatic eye was diagrammatically presented. The usual method was by diagrams showing the position of the two focal lines and their shifting back and forth by means of spheres and/or cylinders. If the real entity that enters into the formation of the retinal images—namely, the retinal diffusion spot—is studied, the principle and importance of "meridional balancing" at once becomes apparent.<sup>1</sup>

Williamson-Noble has amplified the procedure and in a series of striking photographs has shown the principles involved as no other method can. In order to maintain "meridional balance," Wil-



Williamson-Noble makes a most excellent suggestion; namely, to use the duochrome test, better known here as the bichrome test.<sup>2</sup> This paper should be read by every eye physician. Another amplification of the subject, showing how the "balanced"

condition can be maintained throughout the test by means of *correcting* cross cylinders as well as *testing* cross cylinders, has been published by the writer.<sup>3</sup>

37 West Ninety-seventh Street.

#### REFERENCES

<sup>1</sup> Pascal, J. I. Arch. of Ophth., 1940, Oct.

<sup>2</sup> Williamson-Noble. Brit. Jour. Ophth., 1943, Jan.

<sup>3</sup> Pascal, J. I. A new approach to cross cylinder tests. New York State Jour. Med., 1943, Feb.

### AN ILLUMINATED RETRACTOR FOR EYE OPERATIONS ESPE- CIALY FOR DETACHMENT OF THE RETINA\*

CONRAD BERENS, M.D.  
New York

Because of the need for good illumination in operations for detachment of the retina, orbital operations, and operations on the inferior-oblique muscle, an

illuminated retractor has been devised. This may be inserted into a flashlight handle (fig. 1) or attached to a cord and rheostat. The retractor is of plastic material, the handle is 51 mm. long, and the tip 18 mm long by 8 mm. in diameter. The tip forms an angle of 165 degrees with the handle. The tip is concavo-convex to facilitate the manipulation of electrolysis and diathermy tips and needles in the hollowed-out part.

The tip is slightly frosted to project the light onto the scleral surface.

35 East Seventieth Street.

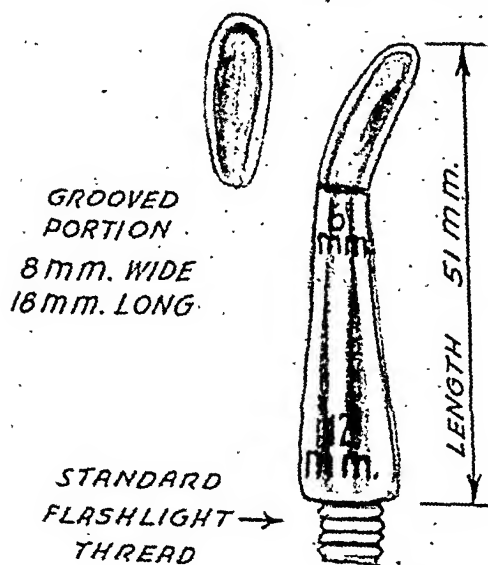


Fig. 1 (Berens). An illuminated plastic retractor.

### A COLOR FILTER FOR RETINAL PHOTOGRAPHY\*

FERDINAND L. P. KOCH, M.D.  
New York

It has become necessary for many who use the carbon-arc models of the Zeiss-Nordenson retinal cameras for color delineation of the eyegrounds, to decelerate their activities in this respect because of the relative scarcity of daylight Kodachrome film in the bantam pack (K828), although those who work with the later nitra-lamp instruments still are able to

\* This study was aided by a grant from the Ophthalmological Foundation, Inc. Made by V. Mueller & Company, Chicago, Illinois.

\* From the Departments of Ophthalmology of the College of Medicine, New York University and Bellevue Hospital.

obtain the artificial-light Kodachrome (K828A). The latter, perhaps, does not afford quite so true a coloration as does the former but it is adequate. Similar, reasonably true values may be attained with carbon-arc illumination and artificial-light color film if one resorts to the expediency of using an accessory filter.

This may be done inexpensively with the use of a Type A, C4-Harrison filter, which may still be purchased on the open market. One may obtain it in various sizes according to whether the operator

of the camera wishes to place the filter in front of the objective lens at the patient's end of the photographic tube or to have it reground for placement in the small, removable filter frame that is received into a slot in the stationary vertical tube situated between the shutter housing and the prism-placement grouping just to the rear of the source of illumination. It is not necessary with this device to alter one's amperage and exposure tables.

780 Park Avenue.

## SOCIETY PROCEEDINGS

EDITED BY DR. DONALD J. LYLE

### CHICAGO OPHTHALMOLOGICAL SOCIETY

November 16, 1942

DR. LOUIS G. HOFFMAN, *president*

#### CLINICAL MEETING

(Presented by the Department of Ophthalmology, University of Illinois)

#### BILATERAL OPTIC-NERVE ATROPHY (JUVENILE TABOPARESIS)

DR. MARTHA RUBIN FOLK presented the case of A. K., a 16-year-old boy who, when first seen on September 4, 1912, complained of blurring of vision for a period of four years. Vision was 0.1 in each eye. The pupils were unequal in size, the right measuring 4 mm. and the left 3.5 mm.; the left pupil reacted sluggishly to light. Upon ophthalmoscopic examination, the optic papilla was seen to be pale, with clear margins and narrowing of the vessels. Perimetric study showed concentric contraction of 20 degrees of both visual fields to form and color. Homat-

ropine refraction revealed an error of R.E. +2.75D. sph.  $\approx$  +0.25D. cyl. ax. 180°, vision 0.1; L.E. +2.50D. sph., vision 0.1.

The blood Wassermann reaction was 4+, and 1+ Kahn. Colloidal gold curve of the spinal fluid showed 5321555300.

Diagnosis made by the Department of Neurology was that of central-nervous-system syphilis with the possibility of early taboparesis. Antisyphilitic therapy was instituted.

#### CONGENITAL ABSENCE OF LEFT PUNCTA

DR. ROOSEVELT BROOKS presented H. B., a man, aged 22 years, who was referred by the Selective Service Board for correction of tearing in the left eye.

On examination, the right eye was found to be entirely normal. The left eye was watery but the conjunctiva was not injected. Complete absence of the puncta above and below was found. No opening of the lacrimal sac could be found in the nose and it was assumed that the sac was also absent.

**Operation:** An incision was made in the skin slightly nasalward to the position of the lacrimal sac and the nasal bone was exposed, through which an opening was made into the nose. A double silkworm gut suture was passed from the lid margin at the site of the puncta into the wound, then into the nose. The lower end of the suture was brought out of the nose and fastened to the cheek. One week later a small silver tube was threaded over the silkworm suture into the nose and the sutures were then removed. The end of the tube in the nose was bent downward, the upper end was bent nasalward over the bridge of the nose and fastened by adhesive tape.

It was hoped that by this procedure epithelization would occur. No record of a similar case was found in the literature.

#### PEMPHIGUS OF THE CONJUNCTIVA

DR. CARL APPLE reported the case of a woman, aged 71 years, who had a purulent discharge from the right eye for two years, and from the left eye for six months. Following bronchitis two years ago, she had continued sore throat, choking spells with hemoptysis, and blisters on the tongue, which bled at times; there were ulcers on the palate, tongue, pharynx, and epiglottis. Dysphagia had been present for a year and a half.

X ray of the lungs showed negative findings; sputum was negative for acid-fast bacilli; smears were negative for fusiform bacilli or spirochetes; blood Wassermann test was negative. The blood count showed 4,500,000 red cells; 11,500 white cells: 41 percent lymphocytes, 48 percent neutrophiles, 4 percent eosinophiles, and 7 percent mononuclears.

Pemphigus of the conjunctiva usually occurs with lesions of the mucous membranes of the mouth, throat, and nose; rarely in conjunction with eruptions upon

the skin. Bullae are exceptional; denuded areas are found in the conjunctiva, which rupture from pressure of the exudate beneath and result in scarring, with final constriction and disappearance of the retrotarsal folds and adhesion of the lids to the bulb. Ulcers of the cornea may occur in the late stages.

#### DERMATOLOGIC LESIONS ABOUT THE EYES

DR. OLIVER S. ORMSBY read a paper on this subject which was published in this Journal (August, 1943).

*Discussion.* Dr. Robert Von der Heydt inquired about riboflavin deficiency, and whether this treatment was given in cases of acne rosacea with involvement of the nose and "butterfly" lesions on the cheeks. With reference to the eye changes in lupus erythematosus, this condition involves the eye but little in comparison with the skin, and these patients are almost exclusively seen and treated by dermatologists.

Dr. Sanford Gifford asked whether the Macht test is considered to be of diagnostic value in pemphigus. In 8 or 10 cases the tests had been reported as highly toxic. Dr. Ormsby had mentioned the deep lesions in the cornea caused by pemphigus, but in his own experience, while there is scarring, the lesions are very superficial; the bullae rupture and there remains but a little erosion, with no hypopyon. It seems that the epithelium is chiefly affected, and is replaced by thick horny epithelium that covers the cornea.

Dr. Ormsby, in closing, said with reference to the effect of light in producing lesions or causing exacerbation of symptoms in rosacea and pellagra, there is a definite influence on the last-named disease. In Peoria and other state institutions some years ago, while pellagra was being investigated, fenestrated gloves were used on many patients and the hands were exposed to the sun. In the

open areas of the gloves pellagrous symptoms developed very actively. On the other hand, many patients were seen who developed lesions in areas not coming in direct contact with the sun's rays. One elderly patient who had been bedridden for years was in a comparatively dark room; the pellagra was well developed and the cutaneous lesions were very active. It is not believed that the actinic rays produced pellagra but that they are effective in bringing out the lesions in a sensitized skin. Goldberg, who did the remarkable work on food deficiencies in pellagra, stated that during winter months (when patients in the South have little pellagra-preventive foods) vitamin deficiencies occur that cause an acute outbreak in the spring when the sun's rays become more potent. Most of the cases occur from March to June. The part that hematoporphyrin plays in sensitizing the skin in these patients is debatable. No particular effect has been observed of the sun's rays on rosacea.

Ocular tuberculosis associated with tuberculosis of the skin is quite common; this was not discussed here for lack of time. Lupus erythematosus of the conjunctiva and lids was mentioned because this condition has been recognized only for a few years; if attention is called to it more cases will be detected. As it can be cleared up with treatment, a proper diagnosis is valuable to the patient.

Concerning the effects of riboflavin in rosacea, very little effect has been seen on the cutaneous lesions, but a decided effect has been noted on the ocular lesions associated with rosacea.

The description of ocular pemphigus was made as a composite of a large number of cases recorded all over the world by dermatologists and ophthalmologists, particularly the latter. In the early stages the vesicles are always superficial and usually leave without trace. Later, when

the disease attacks deeper tissues of the eye and sclerotic changes occur, vesicles no longer develop, although they may be found on other mucous membranes. The Macht test is used as a confirmatory finding; a positive test is valuable in confirming the diagnosis of pemphigus. It is a phytopharmacologic method of testing the toxicity of the blood serum for plant protoplasm. In about 90 percent of patients with pemphigus the blood serum shows greater toxicity than that of normal persons.

As most cases of contact dermatitis are of allergic or hypersensitive nature, and as sodium thiosulfate is the most valuable drug in overcoming sensitization, we have found it of great value in this type of dermatitis. It is used in dosage of one gram intravenously three times a week for a week or 10 days. Two excellent local applications consist of the aqua calcis lotion and a naftalan ointment. The first preparation contains sodium baborate 10 grams, powdered zinc oxide 15 grams, powdered starch 15 grams, liquor calcis 120 grams, and aqua rosa q.s. ad 240 grams. A very efficient ointment consists of naftalan 6 grams, powdered zinc oxide 15 grams, powdered starch 15 grams, and petrolatum to make 60 grams. It has not been found necessary or advisable to use phenol in the aqua-calcis lotion.

#### THE USE OF PRISMS IN OPHTHALMOLOGY

DR. GEORGE P. GUIBOR presented a paper on this subject which appeared in this Journal (August, 1943).

*Discussion.* Dr. Richard Gamble said that he had had the opportunity of watching Dr. Guibor develop his ideas and put them to use. The theories are fascinating and the results are good. The most valuable suggestions he made are the explanation of overaction of the inferior oblique muscle by synkinesis, the use of prisms, base out, undercorrecting the deviation

in convergent concomitant squint, and the use of prisms, base out, for external-rectus paralysis.

His explanation of the reason for overaction of the inferior-oblique muscle is the only one that seems reasonable. It is usually not possible to demonstrate paralysis of the superior rectus of the opposite eye to one's satisfaction. Another important point is the fact that overaction of the inferior-oblique muscle is extremely common in children but is very seldom seen in adults. This would not be true if it were due to paralysis of the superior rectus of the other eye.

In regard to the use of prisms, base out, undercorrecting the deviation in convergent concomitant squint, one likes to think of the first page in Traquair's book on "Perimetry," in which he refers to the visual field as a "hill of vision in a sea of blindness." In this hill the peak corresponds to the fixation point, the hill slopes off gradually on each side of the peak for about 10 degrees, then slopes off rapidly. The use of prisms, base out, undercorrecting the deviation would be an attempt to make the image fall on the side of this hill, and the eye should then move out sufficiently to have the image fall on the fixation point. If this is so, why did Dr. Guibor not order prisms correcting all the deviation less 10 degrees, instead of correcting much less? It is disappointing that he finds that the use of prisms in this manner is not effective in cases of abnormal retinal correspondence. Would Dr. Guibor make a more definite statement concerning the value of prisms in cases of alternating convergent squint? are they less effective than in cases of monocular squint?

With reference to the use of strong prisms, base out, in cases of paralysis of the external-rectus muscle, he was not so enthusiastic as the essayist. It seems he is doing very little more with these un-

sightly lenses than the patient does by merely turning his head toward the side of the paralyzed muscle. The important point is whether or not there is contracture of the internal-rectus muscle. If that develops before the paralysis recovers it will take more than prisms, base out, to relieve it.

Dr. George P. Guibor, in closing, said that motor defects are always undercorrected with prisms because one is unable to determine the amount of spasticity present. Likewise, it is easier to add more prism to a deviation that is not improving than to remove prism from a patient who is using full correction.

Dr. Gamble is correct in his criticism of the use of prisms in treating paretic deviation, especially so when these deviations are associated with severe suppression and contracture of the opponent muscle. However, in partial defects not associated with contracture, prisms are of considerable value.

Robert Von der Heydt.

## SAINT LOUIS OPHTHALMIC SOCIETY

November 27, 1942

DR. LESLIE DREWS, *president*

### DENDRITIC ULCER

DR. F. O. SCHWARTZ read a paper on this subject which was published in this Journal (1943, v. 26, p. 394).

*Discussion.* Dr. M. H. Post said that he had noticed repeatedly that dendritic ulcers heal rapidly on removal of foci of infection, but he had a feeling, too, that this disease is self-limiting to some extent. He had seen cases in which no foci of infection could be found, in which the lesion resisted all local treatment, but, continuing this same local treatment, something took place in the system, and

the eye suddenly healed very rapidly. He said that he had not had much luck with the thermophore in this type of lesion.

Dr. Post said that Dr. John G. Bellows had issued a word of warning about the use of sulfa drugs in lesions of the cornea. Since the action takes place only in vascularized tissue, there is a tendency for these drugs to induce vascularization of the cornea in the region of the ulceration.

Dr. William Shahan said he had found that local applications of 1-percent silver nitrate used very cautiously, tracing the open branches of the ulcer, make them well in three or four days. Of course, when the cases are protracted he also sent the patient to some rhinologist and then to the family doctor.

Dr. Roy Mason said he would like to ask Dr. Schwartz about his case in which the patient was struck by the limb of a cherry tree. He had had a number of these cases preceded by some sort of trauma. One patient got cement dust in his eyes. In a few days he developed a dendritic ulcer. Did the accident activate it or aggravate it? There are very good textbooks that fail to answer this question, but give the impression that trauma has something to do with dendritic ulcer. He has felt that the condition was not due to trauma but, like Dr. Schwartz, to some virus or toxin. So many cases, however, are preceded by slight trauma.

Another phase of the subject is the use of the sulfa drugs. He has been using sulfathiazole internally in these cases and it seemed to him that the patients have been getting well much faster than before.

Dr. F. O. Schwartz (closing) in answer to Dr. Shahan, said he used the thermophore at 154°F. for one minute.

He had seen a number of cases of dendritic ulcer following injuries; about half a dozen patients had been improved

after the removal of corneal foreign bodies but had returned in a week or 10 days with dendritic ulcer. He was inclined to think the injury paved the way for the development of the ulcer. He had never seen the condition occur in both eyes.

#### CORNEAL RESECTION FOR DYSTROPHY

DR. VINCENT L. JONES presented the case of a woman, aged 43 years, who had come under his observation in March, 1939. The corrected vision in each eye had been 20/20. Corneal dystrophy or degeneration (without gutter formation) progressed from the periphery until, in February, 1942, the entire cornea in each eye was involved. Vision was limited to the detection of gross motions.

On May 11, 1942, corneal resection was performed, following the method of Meyer Wiener. Erythema doses of X rays were given under the direction of Dr. Sherwood Moore. Healing was uneventful. On August 21st, vision in this eye was 20/400, and on November 25th the vision had improved to 20/200.

*Discussion.* Dr. William James pointed out the need for better terminology to avoid confusion in discussing corneal conditions. In obscure, so-called dystrophies of the cornea he had used corneal resection in seven cases; four received beneficial results. Yet after about four or six months the cornea became opaque from what he judged was edema. The patients were not benefited permanently at all. To resect down to firm healthy tissue is worthwhile in a great number of cases of scars and erosions of the cornea.

Dr. John Green wished to commend Dr. James on his technique of corneal resection. Dr. James was kind enough to assist him in one case. It was a beautiful demonstration of how the scar tissue can be dissected off in the proper plane of dissection.

In cases of bullae it was quite remarkable how one can get rid of them without regeneration. Not only Ewing but Allen of Chicago showed that the genesis of a bullous keratitis was a disease of Bowman's membrane. If one removes the superficial layers of the cornea including Bowman's membrane a quiet eye will result. Most of his cases had been in blind eyes that could not be removed for some reason.

James H. Bryan,  
*Editor.*

## COLORADO OPHTHALMOLOGICAL SOCIETY

November 28, 1942

DR. JAMES M. SHIELDS, *president*

### DETACHMENT OF THE RETINA AND CATARACT EXTRACTION

DR. WILLIAM M. BANE presented the case of Mr. R. B., aged 23 years, who was examined by Dr. J. L. Swigert on December 1, 1933. He had symptoms of eye strain with some blurring of vision and a chronic facial eczema. His vision was O.D. 20/20; O.S. 20/50-1. There were also bilateral posterior capsular cataracts, larger in the left eye. Weak lenses were ordered but they did not improve the vision. The fundi were normal. On May 9, 1939, the patient complained of more loss of vision. Examination revealed numerous vitreous floaters in both eyes, also a retinal detachment in the right eye, lower temporal quadrant. This was operated on with immediate good results by Dr. Swigert.

After the first operation there developed what was thought to be a secondary detachment. This was not at the periphery, which seemed healed, but near the center of the original separation. A guarded prognosis was given. A second

operation was performed by Dr. Swigert, with good results and no complications.

Early in 1942, the patient went to the Mayo Clinic for his eczema. A diagnosis of atopic dermatitis was made.

On October 5, 1942, examination revealed a mature cataract in the right eye. This was operated on by Dr. William M. Bane with excellent result. Vision with correction at this time was O.D. 5/20-1; O.S. 5/20-1.

### ENDOPHTHALMITIS SECONDARY TO TRAUMA, WITH RECOVERY

DR. RALPH W. DANIELSON presented a 13-year-old boy, who was first seen for refraction in March, 1941, at which time it was found that he was practically emmetropic, each eye, with a vision of 20/15.

He was next seen on June 25, 1942, because on the day before he had been struck in the right eye with a piece of wood.

On examination, it was found that a flat, more or less oblong, sliver of wood was extending through almost the entire thickness of the cornea in a slanting manner. This was removed with considerable difficulty, the attempt being made to avoid pushing the piece of wood into the anterior chamber and injuring the lens. The patient was placed on sulfathiazole, about 0.5 grain per pound of body weight, but in a couple of days it was noted that the cornea was definitely becoming opaque and a hypopyon was developing in the anterior chamber. The sulfathiazole was increased to 0.75 grain per pound of body weight, but, in spite of this, by June 29th, there appeared to be a hopeless endophthalmitis, the cornea showing an increase in opacity and the anterior chamber being so full of hypopyon that the iris could not be seen. It was felt that something drastic would have to be attempted. The sulfathiazole was, therefore, increased to



1 grain per pound of body weight; and a very extensive Saemisch incision was made at the pupillary border, which drained the anterior chamber completely.

This wound was re-opened twice a day for the following week and once a day for several days more.

On July 3d the patient's temperature rose to 103°F., and it was necessary to stop the sulfathiazole. The use of typhoid paratyphoid vaccine was substituted. The eye gradually cleared, leaving an intra-stromal abscess which was opened from the exterior on August 1st and again on August 3, 1942.

On July 24th, the administration of riboflavin, 2 mg., three times a day, was begun. The uncorrected vision at the present time is 20/65, and with a minus 2.50D. sph.  $\approx$  +3.50D. cyl. ax. 103°, the vision is 20/15.

This case is presented primarily to demonstrate an eye which, although apparently hopelessly lost, was saved by a combination of sulfathiazole and wide incision of the cornea; (2), the use of riboflavin to increase corneal nutrition; and (3), the remarkable amount of vision now obtained.

*Discussion.* Dr. Neepser thought phemerol would have been a great help in the early stages of this case. He reported very good results with its use.

#### SUCCESSFUL RETINAL-DETACHMENT OPERATION IN APHAKIA

DR. RALPH DANIELSON and DR. JOHN LONG presented the case of I. G., a 65-year-old white woman who had had an intracapsular cataract extraction on the left eye in November, 1940. The operation at that time was uneventful and no vitreous was lost. The corrected vision following cataract extraction was 20/20.

On May 21, 1942, a large bullous detachment of the retina, left eye, occurred, and a tear was found in the upper tem-

poral quadrant. This was treated with multiple diathermy punctures. Healing has been satisfactory, the retina having gone back into place; at the present time the corrected vision of the eye is 20/33. The margins of the old tear and the surrounding area of choroidal scarring are plainly seen.

#### DERMOID CYST OF THE BROW

DR. JOHN LONG presented the case of B. M., a 13-year-old Spanish-American girl. The patient had had a gradually increasing swelling of the lateral angle of the left brow since birth. On November 10th, a cyst, measuring 1.5 cm. in diameter, was excised. This cyst was found to be beneath the orbicularis muscle and not attached to the bone. On opening the cyst, it was seen to contain sebaceous material and numerous tiny hairs. A diagnosis of dermoid cyst was made.

The origin of dermoid cysts was discussed at some length and the theory of Collins and Mayou was mentioned. According to this theory, a dermoid cyst is an inclusion resulting from adhesions between the skin and the suture lines of the skull in early fetal life.

Photographs of the patient and gross and microscopic photographs of the tumor were shown.

#### FOSTER KENNEDY SYNDROME

DR. W. A. OHMART presented the case of Mrs. D. W. H., aged 28 years, who came to the office on October 22, 1936, complaining of blurred vision. Examination showed an optic atrophy of the left eye. The right eye was apparently normal. Visual acuity at the time was O.D. 20/25; O.S. nil. No lens was of help. The patient stated that Dr. Rudolph Jaeger had operated on her about six years previously for a brain lesion.

In July, 1942, she was again exam-

ined, and a typical Foster Kennedy syndrome was found. A papilledema of about 2 mm. of the disc of the right eye was found. The optic disc of the left eye was atrophic.

She was operated on again by Dr. Rudolph Jaeger.

She again was examined in November, 1942. A peculiar macular lesion was found in the right eye. Optic atrophy was present in the right eye.

For all practical purposes the patient is blind.

*Discussion.* Dr. Rudolph Jaeger discussed the surgical aspects of the case. Both operations showed the carotid arteries compressing the nerve. Removal of the roof of the optic canal allowed the nerve to be pushed up without pinching against bone.

No enlargement of the pituitary was found at operation.

Dr. W. H. Crisp thought the macular involvement was a capillary breakdown.

Walter A. Ohmart,  
*Secretary.*

## MEMPHIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

December 8, 1942

DR. D. H. ANTHONY, *presiding*

### CONSTANT OCCLUSION IN AMBLYOPIA

DR. E. C. ELLETT reported three cases to illustrate the value of occlusion in the relief of amblyopia. Only constant occlusion was of any value. Anything less was waste of time. The surgical, refractive, and other features of these cases were omitted; they were reported as a few of a good many cases in which the vision was improved by the forced use of the amblyopic eye.

The first patient was L. H., aged six

years, who was seen in April, 1942, with a periodic squint, both eyes turning in under cover, and with an esophoria of 8 degrees. The motion in was stopped by 25-degree prism, base out. Vision in the right eye was 6/15 and J4, and in the left eye 6/6 and J1. On August 4th constant occlusion of the left eye was begun. On October 23d the vision in the right eye had improved to 6/6 slowly, and on November 7th it was 6/6 and J1.

The second patient was A. C., a five-year-old girl, who seen in July, 1942. She had a paresis of the right third nerve, manifested by right hypertropia, ptosis, and a dilated pupil. The vision in the right eye was normal. The vision in the left eye was 6/60. Under constant occlusion of the right eye the vision in the left eye improved to 15/30 in three months, and in five months the vision was 6/6.

The third patient, B. L., a two-year-old boy, was seen in 1938, with convergence of the left eye amounting to 28 degrees. It was not possible to test the vision until a year later, when it was found to be 1/60 in the right eye, and 6/10 in the left eye. Constant occlusion of the left eye was begun in October, 1939, and in January, 1942, the squint was found to be alternating, after which the eyes were occluded alternately. In November, 1942, vision was 6/12 in each eye.

### SPASM OF THE CENTRAL RETINAL ARTERY

DR. E. C. ELLETT presented the case of P. R., aged 61 years, who stated that his vision began to fail in April, 1942, the left eye being affected and only at times. The vision was about 5/60 in each eye with glasses. The blood pressure was 126/80. He had had some bad teeth removed and the physical examination otherwise was negative. On the morning he was seen, August 5th, he had four

spells of blurring of vision. He was seen during one of them. Some of the retinal arteries were entirely empty of blood, some showed a broken column. While the eyeground was under observation, the arteries began to fill from the disc end and were soon normal. The time was too short to permit testing the vision and field while the spasms were present, and it was too interesting and unusual a sight to miss the chance to watch it. In September, and again in December, 1942, he reported no further attacks and he has resumed his work as a railroad engineer.

#### LENS EXTRACTION IN HIGH MYOPIA

DR. E. C. ELLETT reported the case of N. J., a 58-year-old man, who had been under observation for 33 years. He had worn glasses for 15 years prior to his first visit, and his vision was 20/40 in each eye with  $-13.00D.$  sph. He gradually developed some myopic changes and a few vitreous opacities, and the vision became worse. In 1937, visible lens changes were noted and they gradually progressed. In July the vision in the right eye was 6/60 with  $-18.00D.$  sph. and in the left eye 6/18 with  $-11.00D.$  sph.  $\ominus -5.00D.$  cyl. ax.  $30^\circ$ . In October, a preliminary iridectomy was done in the right eye, and, in November, an intracapsular cataract extraction. He had a slight anterior-chamber hemorrhage on the sixth day but this disappeared in 24 hours. His vision in the right eye was 6/9 with  $+2.00D.$  sph.; with  $+2.50D.$  sph. added he could read J2. He was greatly pleased with the new lighter glasses, and with the improved vision.

#### CONGENITAL PTOSIS

DR. RALPH O. RYCHENER reported the case of P. W., aged nine years, who had had a modified Motaïs operation performed on the right eye two months previously with resultant overcorrection,

followed by diplopia, lacrimation, and exposure of the cornea, due to incomplete closure of the lids. On September 9, 1942, with the aid of Dr. P. M. Lewis, the tissues of the upper fornix were taken down, the tongue of the superior-rectus muscle isolated and reattached to the insertion of the ocular muscle, and the levator palpebrae muscle was resected for 4 mm. and the stump sutured to the tarsus. Slides were exhibited of the various preoperative stages along with the final result, which was perfect.

#### RECESSION FOR HYPERPHORIA

DR. RALPH O. RYCHENER reported the case of R. F., an 18-year-old boy, who was rejected by the Navy because, as the examiner expressed it, "his eyes didn't look right" although his visual acuity was normal. There was a left hyperphoria of 28 degrees due to a paresis of the right inferior-oblique muscle. On July 15th, a 5-mm. recession of the left superior rectus was done, with excellent cosmetic result although on September 8th there was still a demonstrable left hyperphoria of 15 degrees. He was accepted by the Navy on September 10th. Slides were exhibited.

#### LACERATION OF CORNEA AND SCLERA

DR. RALPH O. RYCHENER reported the case of D. A. C., aged 37 years, who was injured two weeks previously when a soft-drink bottle had exploded in his hand, cutting the right upper lid and lacerating the cornea and sclera. The lid was well repaired but there was a 15-mm. laceration of the cornea at the 9-o'clock position extending up and nasally into the sclera, with prolapse of the iris and ciliary body and marked ciliary injection. Visual acuity seemed fair, and it was determined to apply pure trichloroacetic acid to the wound in the hope that a resistant eschar would be formed. After

two weeks the wound was flat and required no further treatment. On December 4, 1942, the visual acuity was 6/60 but was improved to 6/7.5 and J2 with +4.50D. sph.  $\approx$  -13.00D. cyl. axis 100°. A slide was shown.

#### SYMMETRICAL MUSCLE PARALYSIS IN IDENTICAL TWINS

DR. RALPH O. RYCHENER reported, with color slides, the cases of S. O. and L. O., four-year-old identical twins, whose mother had noticed that one eye failed to move upward in certain positions. In the one this proved to be due to a paralysis or absence of the right inferior oblique; in the other to a similar condition of the left inferior oblique. Binocular vision with the Worth dot test without demonstrable diplopia was present in the primary position. No treatment was advised.

#### MYASTHENIA GRAVIS

DR. J. WESLEY MCKINNEY presented a case report of W. S., a 65-year-old man, who was first seen in June, 1940. On the first visit the left upper lid began to droop and in about one month the right upper lid also began to droop. At this time there was also weakness of the jaw so that he had to hold the jaw to be able to chew. There was a paralytic ptosis of the upper lid of each eye varying in degree at different times of observation. All the muscles of the face seemed to sag. The jaw jerk was absent. The ocular rotations were normal and there was no diplopia.

The patient had pernicious anemia and it was thought at first that this was the cause of the ptosis. At one of his visits to the office he was given prostigmine methyl sulphate by hypodermic injection. Within 15 minutes the ptosis had disappeared and the facial expression became normal. His condition varied con-

siderably over the next year and a half but for the most part he had been able to control the ptosis and weakness of the facial muscles with prostigmine by mouth. There has been no spread of the weakness to other muscles.

On one occasion he came in for refraction at a time when the lids were drooping so much that most if not all of the pupil in each eye was covered. After the injection of prostigmine the lids became normal and refraction was carried out without difficulty.

#### ARGYLL ROBERTSON PUPIL, CONGENITAL

DR. J. WESLEY MCKINNEY reported the case of H. S., a 46-year-old man who was seeking relief from presbyopic symptoms. When it was found that his pupils were very small the patient said that they had always been small. He had had thorough physical examinations on various occasions; these were always negative. The eyes were entirely normal except for the fact that the pupils measured less than 1 mm. in diameter in each eye. They were equal in size but did not react to a strong light, but reacted promptly to convergence. The pupils dilated to 3 mm. in each eye a short time after the instillation of paredrine. This eliminated a parasympathetic paralysis as the mechanism of the condition. The patient refused spinal puncture.

#### SUCCESSFUL RESULT IN OLD RETINAL DETACHMENT

DR. DEXTER J. CLOUGH, II (by invitation) presented the case report of a 10-year-old boy, who was found to have greatly reduced vision in his left eye when examined by school authorities. The boy and his family were previously unaware of this visual defect. A history of trauma at the age of three years, when the child sustained a fractured nose, was elicited.

Vision in the left eye was limited to perception of hand movements at 3 feet. Ophthalmoscopic examination revealed an almost total detachment of the retina with a massive bulging inward from both the temporal and nasal sides. The patient was hospitalized, and after two days of absolute bed rest in the supine position and fixation of the eyes during the waking hours by appliance of pin-point disc spectacles, there was enough regression of the retinal elevation to reveal a small retinal tear in the upper nasal sector just anterior to the equator.

Diathermy operation for the retinal detachment was carried out, with the use of both the Weve surface-diathermy technique and the Walker micropin technique, about the site of the retinal tear localized on the sclera and over the upper hemisphere of the globe between the ora serrata and equator. Subretinal fluid was released through two trephine holes, one over the upper nasal sector and one over the upper temporal sector to correspond to the nasal and temporal bulging of the retina. Postoperatively the retina was found to have completely reattached, and the vision in this eye a month later was 6/24+ with a full field.

It was not known definitely whether the detachment had existed for seven years, that is, from the time of the nose fracture, but it is probable that it had existed for a considerable time. In view of such an unfavorable prognosis, the good result would encourage the operative interference of any retinal detachment regardless of its duration.

#### GLAUCOMA SECONDARY TO DISCISSION

DR. J. WESLEY MCKINNEY reported the case of F. C., a 56-year-old man, who had had a successful intracapsular cataract extraction in the right eye. When the left eye was operated on, it was found that the capsule was too tight

to be grasped with forceps, which fact necessitated an extracapsular extraction. A moderate amount of cortex was absorbed rapidly, leaving a fairly dense secondary membrane.

The patient returned for discission two months after the operation. By mistake atropine was instilled preoperatively instead of homatropine, giving very wide dilatation of the pupil. The membrane was needled and a large pupillary opening was obtained.

Two hours after the operation the patient complained of pain which became increasingly severe. The eye became stony hard. For three days the pain was intense; the pupil remained dilated, and tension remained high despite the use of eserine, mecholyl, prostigmine, and heat. The pupil began to constrict on the morning of the fourth day and the tension was less. By afternoon the tension was normal. The tension has remained normal for two years, without the use of miotics, and vision was corrected to 20/15.

#### GUNSHOT WOUND OF THE EYE AND BRAIN

DR. PHIL LEWIS reported the case of H. S., a colored man, aged 28 years, who was admitted to the eye service of John Gaston Hospital on July 5, 1942, because of a gunshot wound of the left eye. He gave a history that a shot gun was fired at him at the distance of about one-half block. Several shot hit him but only one above his shoulders. He entered the Hospital two hours later complaining of pain in the back of his head and loss of vision of his right eye.

Examination on the following day showed that a shot had perforated the center of the lower right eyelid about 3 mm. from the border. There was a round hole in the sclera about 4 mm. from the limbus in the 5-o'clock meridian. The anterior segment of the eye

was normal except for a dilated pupil which did not react to light. The vitreous was full of blood so that the fundus could not be seen. There was no perception of light. X-ray studies were made to determine the position of the shot. Much to our amazement it was found to be in the lower occipital region and all the ventricles of the brain were filled with air.

Two days later the patient's temperature had risen to 100°F., and he complained more of headache. Further X-ray studies showed the amount of air to be about the same. The optic foramen was normal. No fractures of any part of the skull or sinuses were found. The following day, because his neck was stiff, a spinal puncture was ordered and consultation was requested with the neuro-surgical department. Sulfapyridine was given in the amount of 90 grains a day. The patient's temperature rose to 104°F. He became delirious and the interne was unable to do a satisfactory lumbar puncture. The patient was quite ill for about four days and then began to recover rapidly. An X-ray examination of the skull on July 25th showed that the air had been absorbed. He was discharged from the Hospital in good condition except for the loss of vision in the right eye. The blood in the vitreous had absorbed sufficiently to allow the examiner to see that the retina was detached. The eye was totally blind.

The patient was not seen again for almost two months. He then came in with his eye severely inflamed and very painful. Examination showed an iridocyclitis, fresh blood in the anterior chamber, and secondary glaucoma. Enucleation with glass-ball implantation was performed and was followed by an uneventful recovery.

Abstract from the report of the Army Medical Museum was as follows: Scleral

scars at the points of entrance and exit of shot, dislocation and cataract of lens, recent and old organizing hemorrhages, detachment of the retina, which was drawn over toward the scleral scars.

*Comment.* It is obvious that the bullet must have traversed the eyeball and orbital tissues and passed through the supraorbital fissure. That it did so without injury to the various important structures in this area is remarkable. Even more remarkable is the fact that it caused the ventricles to become filled with air. Just how this occurred is not clear. Probably a posterior ethmoid cell or the sphenoid was opened and the air came from that source. Certainly the ventricles were pierced in some portion. Complete recovery occurred except for the loss of the injured eye.

#### SEVERE PROCAINE REACTION

DR. PHIL LEWIS reported a case of near fatality presumably from injection of procaine hydrochloride for a minor plastic operation on the eyelids.

Mr. J. D. R., a white man, aged 73 years, was admitted to the John Gaston Hospital on September 18, 1941. He had an old inactive trachoma with a moderate entropion of the lower eyelids. Considerable corneal irritation was present due to trichiasis. Plastic surgery on the lids was to be done first, and extraction of senile cataracts at some later date was contemplated. Routine physical examination was negative. The man was apparently in excellent general condition.

On the morning of September 19th, he was given 3 gr. of nembutal at 7:15 a.m. At 8 a.m. 4-percent cocaine hydrochloride and epinephrine 1:1,000 were dropped into each eye several times (6 drops of cocaine and 3 of epinephrine in each eye). At 8:15 a.m. both lower lids were infiltrated and the sensory nerves blocked by injections of 1-percent pro-

caine hydrochloride with one drop of 1:1,000 epinephrine per cubic centimeter. A total of seven cubic centimeters of procaine was used. An incision splitting the right lower eyelid was begun. Immediately the operation had to be discontinued due to a sudden, alarming change in the patient's condition. He took a few deep, rapid breaths, became extremely cyanotic and stopped breathing. The heart ceased beating. Artificial respiration by rhythmical pressure and relaxation of the chest was started while hypodermic injections were being quickly prepared. Coramine (1 c.c.) was injected into the external jugular vein. Epinephrine hydrochloride 1:1,000 (1 c.c.) was injected directly into the heart. An Emerson Resuscitator, which pumped oxygen rhythmically into the lungs was employed. After 10 minutes had elapsed, during which time there was no sound of cardiac action and he was apparently

dead, his heart began to beat very feebly. From then on his improvement was steady and after 30 minutes more he was returned to bed with instructions for very careful watching. After two days he left the Hospital in good condition. The operation was not performed.

*Comment.* In the opinion of all who witnessed this near fatality it resulted from procaine sensitivity. It was true that some cocaine was used but the amount was very small and he showed no symptoms until after the procaine injections. Cocaine had been previously used in his eyes without mishap. This man was clinically dead for 10 minutes and his recovery or resurrection was due to the most efficient services rendered by the Hospital staff. The Emerson Resuscitator certainly played an important part in saving this man's life and was therefore recommended as standard equipment in all hospitals.



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## THE WAGNER BILL

In the medical profession there are not many minority opinions with regard to the Wagner Bill. The profession as a whole has turned its face against any form of the socialization of medicine. We are all thoroughly convinced that the highest types of medical practice are carried on in the very personal relationship of private physician to his patient. It is therefore argued that anything which destroys this relationship must be bad in its very essence.

The writer is not aware that anywhere in the medical periodical literature of this

country has anything been said even mildly favorable to the Wagner Bill. Yet there is some reason to believe that the Bill voices the purposes of one much higher in authority and influence than Mr. Robert F. Wagner, the Senator from New York. Many of us are convinced that the Bill in its present form cannot pass through Congress. But there are others who believe that, with the very influential backing of the highest in the land in alliance with the trade unions, the Bill may have a good chance for becoming law.

It is not expected that anything here said will play an important part in either

passing or defeating the Bill. Yet if there exist in the medical profession and among our own good friends any substantial differences of opinion as to the Wagner Bill we ought to know everything possible about such points of view.

Let us, for the moment, ignore any vote-catching problems involved, even among Senators and Congressmen, and consider only principles and practical consequences. As bearing upon the attitude of the medical profession, the only carefully prepared documents with which most of us are familiar as dealing with the Bill are severely and even utterly condemnatory. Chief of these is the report of the National Physicians' Committee, an organization financially independent although apparently owing its inception to the American Medical Association, and receiving support from some of the large drug manufacturers. A short summary of the medical provisions of the Bill has also been issued by the American Medical Association's Council on Medical Service and Public Relations.

Only one other organization within the medical profession appears to have made a careful attempt to analyze the provisions of the Wagner Bill. This is the numerically small but professionally rather significant group known as the Committee of Physicians for the Improvement of Medical Care, Inc., whose Secretary is John P. Peters, M.D., of New Haven, Connecticut. It may be recalled that this organization came into existence six or seven years before the organization of the "National Physicians' Committee," with its rather imitative title.

Perhaps the most striking feature of the Wagner Bill is its breath-taking comprehensiveness. It would undertake provision of medical care for a total number of persons estimated at from 100 to 110 million. The item of finance is mentally overwhelming. The Bill as a whole (with

its increase probably from 37 to 62 million in the number of persons registered under the Social Security laws) might involve the collection of the staggering total of 12 billion dollars from employers, employed, and self-employed. (The average annual revenue of the United States Government from all sources during the ten years 1924 to 1933 inclusive was 3½ billion.)

Something like absolute authority under the law would be placed in the hands of the Surgeon General of the United States Public Health Service, although with aid from advisory councils (Social Security Council, and Medical and Hospital Council) which would have important functions with regard to organization and administration. The Surgeon General would apparently have power to establish rates of payment for medical services, to decide to whom physicians might provide services, to approve or disapprove hospitals and clinics, to publish lists of physicians entitled to render services under the law, and to establish qualifications for specialists.

The A.M.A.-sponsored committee (National Physicians' Committee) declares that, if enacted into law, the provisions of the Wagner Bill would "destroy the private practice of medicine in the United States"; that "State Medicine means abject slavery"; and that for the mass of people it involves "medical care through and by physicians who are politically amenable rather than by those with superior abilities and skills," as contrasted with "the practice of medicine under the Christian concept of the sanctity of human personality."

The Committee of Physicians for the Improvement of Medical Care is also strongly critical of the Wagner Bill, although this Committee, we are reminded, has already recorded its approval of a national health program. The Committee

does, however, offer constructive comment as to the faults of the Wagner Bill as applied to such a health program. Perhaps the most vital criticism of the Bill, as presented by this Committee, relates to the enormity of the program, the attempt to conjure such a plan out of thin air, lacking the benefits that might be derived from a slower and more evolutionary procedure, with its gradual accumulation of experience and the step-by-step adjustments rendered possible by trial and error and correction. "In an experiment of such vast proportions as that contemplated by the Bill it would seem wiser and more conducive to the improvement of medical care to cover at the start a smaller proportion of the population."

We are reminded that a bill introduced by Senator Wagner in 1939 proposed a national health program financed by grants-in-aid to states complying with the standards of the Federal Government. Such grant-in-aid would have permitted gradual development and local autonomy under Federal supervision.

It is further suggested that a tax-supported system might be more equitable and economical. Such a system would make it possible to provide care at first for those who were most truly in need, leaving room for such further expansion as experience and expediency might indicate.

Much has been said for and against the principles of States' rights as contrasted with Federal control, in relation to many lines of activity. The adoption of legislative innovations for relatively small units of the population has at least the virtue of limiting the mistakes that may arise in new experiments, and of permitting valuable lessons to be learned as to the manner of carrying out novel ideas. But Senator Wagner, and those associated with him in the present proposals for sweeping social change, appear to have thrown

overboard the spirit of caution embodied in their earlier plan. The Committee of Physicians for the Improvement of Medical Care suggests that the scope of the new proposals might well at first be limited to a lower income, say \$2,000 or \$2,500, as compared with the \$3,000 limit provided in the Bill.

The present Bill's provision that hospital service shall be of the type offered by "ward or other least expensive facilities compatible with the proper care of the patient" seems to suggest that those who have been accustomed to purchasing semi-private or private accommodations in hospitals, or to consulting physicians who have comfortable waiting rooms and well-furnished offices, will have to forego the benefits provided under the Bill unless they are willing to accept services of the sort furnished in a ward or dispensary. Or are such patients to be allowed to spend private funds on these services while economizing on their payments to physicians? The Committee of Physicians for the Improvement of Medical Care suggests that, however handled, this problem opens the way for abuse, whether to the advantage or to the disadvantage of the physician.

There are those who believe that Mr. Wagner's Bill cannot pass into law. Others, including the "National Physicians' Committee," recognize a danger that the Bill may pass in its present form and are determined to do all in their power to prevent such an outcome. In this spirit of opposition and determination they refrain from such constructive criticism as might be supposed to acknowledge the possibility of improving a desperately bad proposal. The Committee of Physicians for the Improvement of Medical Care, on the other hand, acts on the basis that certain parts of the Bill ought to be constructively modified. Particularly this Committee emphasizes the

weakness of the Bill as to provision for group practice in and out of hospitals. "Medicine," says the Committee, "has long since passed the stage in which the individual medical practitioner can provide good medical care as a solitary individual." While the Bill appears to give the Surgeon General the right to contract for group service, the Committee urges (1) that groups of physicians so approved shall be qualified to furnish medical services, (2) that beneficiaries or groups of beneficiaries shall be permitted to select the medical groups from whom they shall receive services, and (3) that approved groups shall have their names published on the lists provided for individual physicians.

As contemplating the event of the passage of the Bill, another constructive criticism is to the effect that the Bill does not fully recognize the proper organization and function of hospitals, and that the proposed rates of payment to hospitals are too small to cover costs of services by laboratory staffs, internes, and residents. Also, "there is no separate provision for the payment of physicians who furnish professional services in the hospital. It seems to be assumed: first that every hospital shall be an 'open' hospital in which each family practitioner cares for his own patients; and second, that laboratory, X ray and consulting services are to be paid for separately." The Committee suggests that "such a system would negate the principle of coöperative group medicine."

The Committee of Physicians for the Improvement of Medical Care offers important suggestions as to the maintenance of outpatient clinics. Since under the proposed law a large proportion of the patients who now attend outpatient clinics would be able to consult their own physicians, these clinics could no longer be

maintained unless organized as centers of group practice under the law. For this purpose the Committee suggests that the Surgeon General should be authorized to make contracts with approved outpatient clinics for certain services and that the remuneration of the physicians should be included in such contracts. The Committee, however, points out that only by means of a well-organized and highly developed outpatient service would it be possible to avoid the wasteful tendency (which has arisen under existing hospital-insurance systems) toward hospitalizing patients for conditions that do not require inpatient facilities.

It appears that first visits are or may be excluded from coverage under the proposed law. This, the Committee of Physicians for the Improvement of Medical Care points out, "violates the principles of preventive medicine," since it acts as a deterrent to the early treatment of disease. It also tends to prolong disability. A proposal to limit laboratory benefits under the Bill is condemned as inimical to the best medical care. These exceptions are intended to prevent abuse of the system, but such an object should be, the Committee suggests, accomplished in other ways.

The same Committee expresses serious concern as to a proposal to recognize under the law a system of "fee-for-service." This practice, the Committee points out, has been found (under insurance systems) to encourage malingering on the part of the patient and unnecessary multiplication of service by the physician. It is stated that British physicians, under the system of National Health Insurance, have expressed their preference for per-capita payments rather than fee-for-service. The latter practice is also ill adapted to preventive medicine.

Personal contact with British physi-

cians seems rather to indicate that the British Panel System is viewed with less disfavor among the general physicians than among specialists. If in the United States there are any appreciably varying degrees of hostility to the proposed extension of socialized medicine, it is to be supposed that here again the degree of hostility will be found greater among specialists than among general practitioners. The practice of specialized medicine may on the whole be assumed to carry certain advantages over the practice of general medicine, as to social and professional status, personal independence, and financial gain.

The subject of specialization, as dealt with in the Wagner Bill, is scarcely mentioned in the report of the National Physicians' Committee. The Committee for the Improvement of Medical Care, however, intimates that the Bill's definition "of specialists and the manner in which they may be employed lacks clarity." The latter Committee objects to the Bill's prescription of "the exclusive utilization of standards and qualifications developed by competent professional agencies" (presumably examining boards). While "the standards and certifications of these agencies could, like any other relevant data, be employed by the Council, . . . their use should not be prescribed in the Bill."

It is noted that in smaller communities some general practitioners will have to perform functions which in larger cities will be conducted by specialists, and that provision must be made for compensating the general practitioner who has acquired proficiency in special fields. It is further objected that, while the Bill provides for consultation with specialists, it does not specifically recognize continuous treatment by specialists. The Bill provides that "the services of specialists shall ordinarily be available only upon the advice

of the general practitioners," but the Committee insists that the patient should be given the greatest possible freedom in the choice of a specialist.

It is to be regretted that such constructive criticism as is afforded by the report of the Committee of Physicians for the Improvement of Medical Care has not found more general access to the profession. There are a number of physicians who agree with the conclusion of the Chicago "Committee on the Cost of Medical Care" that some form of national program for the improvement of medical care is desirable. Many of us now contribute heavily of time and skill, without financial recompense, to various forms of socialized medicine. The profession is also supporting certain schemes for group health insurance. But the more we study the ramifications and complications involved, the more we are led to doubt the wisdom of venturing, without benefit of the lessons to be learned from more partial and gradual change, into the enormous and revolutionary experiment proposed under the Wagner Bill.

W. H. Crisp.

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## OUR POSTWAR PROBLEM

The ophthalmologic training centers in the United States are facing a real problem in planning how to meet the demands for ophthalmologic education in the immediate postwar period, demands that are even now mounting in an ever-increasing tide. Owing to the curtailment in the resident service by the armed forces and by the procurement agency, there will be a definite gap in the ranks of well-trained younger ophthalmologists, and it will be the duty of the training centers to make that hiatus as small as possible. Consequently, it is the duty, right now, of the

educators to establish plans and means to care for the influx of men that will flood the ophthalmologic training centers, starting with the beginning of demobilization and continuing for at least two or three years.

Apparently, there will be four main classes to be provided for:

A. Recent graduates who have finished their general internship, who may or may not have served in the armed forces, and who wish to specialize in ophthalmology as their life work. This constitutes the group that have in the past composed the regular resident staff and whose training will proceed along established prewar lines.

B. Residents in ophthalmology whose career was interrupted by service with the armed forces before completion of their training.

C. Men who have had from one to two years (or even more) of training in ophthalmology and who, because of absence from that field of work, require a fairly rapid comprehensive refresher course.

D. Practicing ophthalmologists who have been on duty with the armed forces and feel that they require refresher work before returning to civilian practice.

All four of these groups require separate consideration which must be tempered by the realization that the total number will far exceed any aggregation of ophthalmic students in the past. Consequently, plans elaborated by the training centers must take into account the physical limitations of the centers themselves, such as the amount of laboratory and clinical material available for the necessarily individualized instruction that is so essential in ophthalmology.

The regular resident training of group A should proceed as in the prewar period in general. But care must be taken to limit the number of residents to the prewar level, despite the fact that eventually

each institution must increase its quota of residents to provide an adequate supply of ophthalmologists to the country as a whole. However, that increase cannot be made until the immediate postwar training program has been completed.

Group B presents a somewhat more difficult problem. Each institution has the moral obligation to take back into its resident ranks any man whose training at that institution was interrupted for service with the armed forces, and to complete that training, both in time and scope. This will necessitate practically doubling the resident staff without similar increase in physical equipment or clinical material. That will mean that each resident will have direct charge of fewer patients than in the past, but that can be compensated for by insistence upon more thorough and meticulous work in each individual case. That will also mean that each resident will be given somewhat less surgery to perform than in the past, which may not be an unmixed blessing. It will also mean that under closer direction of the educators, each resident will have more study time available and will emerge from the institution with a better knowledge of the basic sciences (particularly pathology) than in the past. These problems are, of course, peculiar to each training center, but with proper advance planning they can be solved for the greater good of ophthalmology.

The next group is numerically rather small, composed of probably not more than 125 to 150 members, and the problems of this group can be solved rather easily by concerted action of the various training centers. There has been circulated among some of the larger centers a plan to establish an intensive three months' course in ophthalmology, somewhat similar to that given in Vienna in the 1920's, and known as the Fuchs course. Such courses, limited to 25 persons, would be

presented at some six or eight of the larger centers where there is adequate teaching personnel. They would start immediately after the cessation of hostilities and be staggered so as to take care of the men as they are demobilized. The course would cover clinical, didactic, and laboratory reviews of the entire subject of ophthalmology. For the more or less individualized clinical instruction, the class would be subdivided into small groups. Needless to say, the course would be open only to men who had completed at least one full year of formalized instruction in ophthalmology and would not constitute a short cut to the practice. In that or some similar way, this comparatively small group of men whose training falls just short of the desired, could be given the necessary instruction that would fit them to start out in civilian practice. For the success of such a plan, coöperation by the Surgeons General of the armed forces is essential, and this has been tentatively promised.

The last group comprises men who have been in the practice of ophthalmology before their entrance into the armed forces and who wish to fill out the gaps in their knowledge. For these, the formal courses that are presented at various centers throughout the country are inadequate. They do not wish to spend two or three weeks listening to lectures on a heterogeneity of subjects without correlation. They need to observe clinical material and receive some didactic instruction in certain subjects in which they feel they are deficient. For them, attendance at an active teaching clinic offers the best solution available at present. Each clinic must be prepared to receive these men on an informal basis and give them the privilege of browsing, for they know what they need.

All this adds up to the fact that ophthalmology has a job to perform in the

near future and the sooner concrete plans are laid, the less confusion there will be when that job plunks itself down into the lap of ophthalmology.

Harry S. Gradle.

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### THE SHEARD FOUNDATION FOR EDUCATION AND RESEARCH IN VISION

The movement which culminated in the conception of a Foundation for Education and Research in Vision at the Ohio State University had its beginnings with the introduction of the two-years' course in applied optics in the department of physics at the Ohio State University, in 1914. After some years it became obvious that the importance of the work was so great that it warranted four years of training fundamentally devoted to the basic mathematical, physical, and biophysical sciences with their applications in physiological optics, clinical significance, and practical work. It was proposed to set up in the University a department for research in all phases of problems in vision in which there would be postgraduate instruction in the subjects of physiology, physics, ophthalmology, and optometry to students enrolled in the graduate school of the University, with no restrictions other than the necessary educational qualifications.

There were, from the very beginning, *two projects* definitely in mind: (1) The Foundation for Vision, and (2) the School of Optometry. These projects were naturally inclusive in the minds of only those who thought of vision in terms of optometry alone. But in all pamphlets and statements which have been officially issued by the University there has been an attempt, at least, to emphasize the fact that the Foundation is independent of any system of practice and also independent of the School of Optometry, which is a part



of the educational provisions of the University. The Foundation is an undertaking universally applicable to all matters pertaining to vision and has no connections with the School of Optometry other than those which logically arise by reason of the fact that optometry is a subject pertaining to visual science.

It has long been recognized that research in all phases of visual science is proceeding in a number of schools and laboratories with results that justify continuation of the work. The objectives of the studies may be clinical, psychological, physiological, economic, sociological, or commercial. Whatever of good results from these bits of isolated researches should be panned and preserved for application where they can best be employed. A central processing and proving station is required to evaluate the results of such studies as are carried on there and elsewhere, and it is just that purpose that is to be served by the Sheard Foundation. In order that there may be adequately trained teachers in the things of vision, whether they go as teachers or research workers into ophthalmology, optometry, illuminating engineering, visual direction in industry, physico-physiology, psychology, or some other branch of learning, there must be some center possessed of adequate medical and other collegiate departments and a conviction about and interest in matters of vision.

The purposes of the Foundation are:

1. To stimulate research in every way possible insofar as visual problems are concerned, and to give attention in these researches to both matters of theory and of practice.

2. To exercise a leadership in all matters concerning vision of an educational or research character to the end that the Foundation in Vision may contribute the greatest good to the greatest number possible.

3. To provide facilities and contacts with various departments and schools of the University, and to attract outstanding men in some manner interested in vision to spend a sabbatical year or other period of time in study and research.

4. To develop training for those who are concerned in any wise with vision. This, for example, might consist of a single course for illuminating engineers or safety engineers, a course in physiological optics for psychologists, or for optometrists or ophthalmologists.

5. To train those who are to become the teachers and research workers of the future in the fields of ophthalmology, optometry, specialists in industrial visual problems and to carry a limited number of postgraduate students through thesis requirements and to a doctorate degree.

The Foundation will operate under the supervision of a board of directors composed of outstanding men in the fields of education, medicine, industry, and applied optics. The faculty will consist of a number of full-time teachers and investigators, selected lecturers from related schools, and artisans skilled in optical construction. Instruction and research work will be carried on in such subjects as myopia, color vision, dark adaptation, visual standards, accommodation, eye movements, refraction, reading difficulties, orthoptic training, and visual rehabilitation.

The purposes of the Foundation are laudable and the character of its formation and sponsorship unimpeachable. With a competent staff and adequate financial and moral support from medical as well as lay sources it promises to fill the needs so sorely felt at the present time by all groups of professional men who are endeavoring in their own way to relieve distress of sufferers of visual disturbance or to aid by scientific research and application the lessons learned by researches

in applied optics. The Foundation deserves the moral and financial support of the medical profession.

W. L. Benedict.

### BOOK NOTICE

THE READABILITY OF CERTAIN TYPE SIZES AND FORMS IN SIGHT-SAVING CLASSES. By Harold J. McNally, Ph.D. Clothbound, 71 pages. Bureau of Publications, Teachers' College, Columbia University. 1943. Price \$1.75.

An estimate of one child in 500 or over 50,000 of the children in this country are partially sighted and require special educational facilities. Many of these children are in sight-saving classes, of which there are 635. These classes represent 227 cities and 31 states. In New York City there are 88 schools with sight-saving classes, enrolling approximately 2,000 pupils. The education of this large a number of children is a sizable and important undertaking. The author of this book has attempted to determine experimentally the best materials for use in these classes.

Reading tests were made on a large group of partially sighted students, using a variety of types. The reading period and light intensity were controlled. Reading speed and eye-blink frequencies were determined.

The results of the study did not permit the conclusion that any one of the experimental types was preferable to any of the others for use in the sight-saving classes.

H. R. Hildreth.

### CORRESPONDENCE

AN ERRATUM AND FOLLOW-UP NOTE

February 24, 1944

Editor, American Journal of  
Ophthalmology

In reference to an article entitled "Post operative endogenous infection," which I wrote in collaboration with Dr. Daniel Kravitz, on page 170, paragraph 3 (Feb., 1944 issue) it is stated that the patient's vision is 20/10+. This is an error. Vision at the time of writing the paper was but 20/100+, and final vision, about three months later, was 20/50+.

(Signed) Lloyd J. Duest, M.D.

# ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

## CLASSIFICATION

- |  |  |
|--|--|
| 1. General methods of diagnosis                        | 10. Retina and vitreous                                |
| 2. Therapeutics and operations                         | 11. Optic nerve and toxic amblyopias                   |
| 3. Physiologic optics, refraction, and color vision    | 12. Visual tracts and centers                          |
| 4. Ocular movements                                    | 13. Eyeball and orbit                                  |
| 5. Conjunctiva   | 14. Eyelids and lacrimal apparatus                     |
| 6. Cornea and sclera                                   | 15. Tumors   |
| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries   |
| 8. Glaucoma and ocular tension                         | 17. Systemic diseases and parasites                    |
| 9. Crystalline lens                                    | 18. Hygiene, sociology, education, and history         |
|  | 19. Anatomy, embryology, and comparative ophthalmology |

### 4

#### OCULAR MOVEMENTS

Verhoeff, F. H. Recurring attacks of concomitant exotropia each followed by transient esotropia. *Arch. of Ophth.*, 1943, v. 30, Dec., pp. 727-731.

The patient, a Jewish female, first noticed disturbances of the ocular muscles seven years ago at the age of 28 years. Since that time she has had approximately 24 similar attacks. Typically the muscle disturbance has consisted of a severe nonparetic exotropia or exophoria, followed by a transient esotropia. The exophoric and the esophoric phase of an attack each has lasted about one week. At the onset of each attack the patient has had severe headache, nausea, and other symptoms. The entire disturbance is attributed to migraine. Hysteria and other disease factors have been excluded. The possible mechanism of the oculomotor disturbance is discussed in some detail. The phenomena seem best to be explained by the assumption that a vasomotor disturbance associated with migraine first depressed and then temporarily raised the tonus of Perlia's nucleus.

John C. Long.

### 5

#### CONJUNCTIVA

Allen, T. D. Epidemic keratoconjunctivitis from a subjective viewpoint. *Amer. Jour. Ophth.*, 1944, v. 27, Jan., pp. 16-18; also *Trans. Amer. Ophth. Soc.*, 1943, v. 41.

Paradoksov, L. F. Streptocide in the therapy of trachoma. *Viestnik Oft.*, 1943, v. 22, pt. 2, pp. 41-46.

A review of the literature and a report of the author's clinical investigations on 150 cases, five of which are reported in detail. The treatment consists in the internal administration of 0.3 gr. five times daily for ten days, and a repetition of the ten-day course of treatment two to five times, with a five-day interval between courses. Streptocide powder was used locally following expression. The conclusions are that streptocide is an effective agent in the therapy of trachoma; that it is possible to cure suitable cases of trachoma with this agent alone; that better results are obtained by combination of mechanotherapy, in the form of expression and massage, with interrupted courses of streptocide; that

streptocide rapidly reduces the acute inflammatory phenomena in the cornea and conjunctiva, and that streptocide powder used locally gives very encouraging results, being especially effective in pannus and corneal ulcers. (2 tables.) Ray K. Daily.

Pletnieva, H. A. Oculoglandular tularemia. *Viestnik Oft.*, 1943, v. 22, pt. 1, pp. 11-16.

Tularemia becomes an important infection in wartime. While its mortality is low, it rapidly assumes epidemic proportions, and, lasting for months, it causes prolonged periods of disability. The infection may come from hides of infected animals, or from bites and the blood of vermin, flies, mosquitoes, fleas, and mice. The infection may be carried by birds, cats, dogs, horses, or cattle. Infected water-supply and delayed milling of grain are factors in spreading the infection. The possibility of infection from one person to another is still a matter of dispute, but Mitzkevich is said to have produced oculoglandular tularemia in a patient by inoculation of secretion from a papule of a patient with the disease. The author proposes that, in view of our present knowledge of this infection, the term Parinaud's conjunctivitis shall be limited to oculoglandular tularemia, and shall not include cases caused by syphilis or tuberculosis.

Some ophthalmologists regard Parinaud's conjunctivitis as a clinical symptom-complex the etiology of which may vary. Pletnieva believes that with the present laboratory facilities Parinaud's conjunctivitis should be considered synonymous with tularemia. The two important diagnostic tests are the agglutination reaction and the skin test for tularemia. Four cases of oculoglandular tularemia are reported, in

two of which the erroneous diagnosis of dacryocystitis was made, because of the presence of a papule in the region of the lacrimal sac, with a necrotic center. The treatment is symptomatic. Convalescent serum is very effective and is indicated especially in the oculoglandular form to hasten resolution of the conjuncival process.

Ray K. Daily.

Shane, S. J. Oropharyngeal ulceration with conjunctivitis and skin lesions. *Canadian Med. Assoc. Jour.*, 1943, v. 49, Oct., pp. 309-311.

Four cases characterized by severe conjunctivitis, marked ulceromembranous stomatitis, obscure skin lesions, and generalized toxemia, with marked prostration, are described in detail. In the author's patient, the condition became much worse after sulfonamide therapy and was at first ascribed to that therapy. The eyelids were swollen and there was a thin seropurulent conjunctivitis from which the only smear apparently taken was one in which a gram-positive diplococcus was found. Smears from the mouth contained *Borrelia vincenti* and other organisms which were apparently incidental. The possibility of a primary virus infection seems not to have been considered.

Charles A. Bahn.

Williams, H. C. M. Cutaneous and conjunctival diphtheria. *Brit. Med. Jour.*, 1943, Oct. 2, pp. 416-417.

During the eight months prior to April, 1943, there were admitted to the Isolation Hospital, Southampton, from a military hospital, 19 patients who had lesions of the skin or eyes from which the diphtheria organism had been isolated. Of these, 12 were infected with virulent and 4 with avirulent organisms; in the remaining cases tests for

virulence were not carried out. Brief summaries of the 19 cases are given.

No toxemias could be ascribed to the action of diphtheria bacilli in any of these cases. No paralysis ensued. Membranes were seen in three cases of cutaneous infection and in one of conjunctival infection. In all the other cases the lesions had the usual characteristics of the skin condition as originally or subsequently diagnosed. The recognition of cutaneous diphtheria among patients with a variety of skin infections suggests the need for more frequent bacteriologic investigation in such cases. Charles A. Bahn.

## 6

### CORNEA AND SCLERA

Allen, T. D. Epidemic keratoconjunctivitis from a subjective viewpoint. *Amer. Jour. Ophth.*, 1944, v. 27, Jan., pp. 16-18; also *Trans. Amer. Ophth. Soc.*, 1943, v. 41.

Goldenberg, A. Z. The use of albucide in the therapy of seriginous and purulent corneal ulcers. *Viestnik Oft.*, 1943, v. 23, pt. 1, pp. 34-38.

This is a report of a clinical investigation on the use, in corneal lesions, of sodium acetyl sulfanilamide, a water-soluble sulfa preparation manufactured in the U.S.S.R. Of 90 patients treated, 66 had deep purulent corneal ulcers and nine had total corneal involvement. In 64 the ulcer was central, and in 17 peripheral. Eight cases had corneal perforation on admission, and seven a descemetocoele. Bacteriologic studies were made in 65 cases, and the pneumococcus was found in 86 percent. The method of treatment finally arrived at consists of blowing the powdered drug on to the cornea every three hours day and night for the first day, and only during waking hours after the first day.

The only other drug used in these cases was atropine or eserine, as indicated. The tabulated data show that in 60 patients the ulcer was clean and completely covered with epithelium in ten days; and in 39 of these in five days. In 14 cases the ulcer was covered with epithelium in 10 to 15 days. Healing was accompanied by formation of a firm flat cicatrix, restoration of the anterior chamber without the development of corneal staphyloma, absorption of corneal infiltrates, and early abundant vascularization around the ulcer. The advancing edges of seriginous ulcers were arrested on the second day, and hypopyon was absorbed in from 1 to 4 days in 18 of 24 patients. In 9 out of 71 cases vision was the same as on admission, and in 62 it was better than on admission. The average hospitalization time was 19 days but patients with total corneal involvement stayed in the hospital an average of 35 days. Iritis, marked hyperemia, rigidity of the iris, and a tendency to synechia delayed recovery in spite of the favorable process in the corneal lesion. It appears therefore that albucide does not influence the process in the iris as it does in the cornea. The author also notes that local application of this drug does not prevent penetration of the infecting agent into the deep ocular tissues. Ray K. Daily.

Kalfa, S. F. Ether in the treatment of corneal diseases. *Viestnik Oft.*, 1943, v. 22, pt. 2, pp. 23-25.

This is a tabulated report of 25 cases of keratitis (herpetic 6 cases, disciform 4, recurrent erosions 3, traumatic 6, ulcer 1, corneal erosion 1, ulcerative pannus 4) treated with repeated topical applications of ether, with satisfactory results. The only case where it was ineffective was one of seriginous ulcer.

The ether applications are analgesic, and not painful as are iodine applications. Kalfa reports briefly an intractable case of corneal herpes following a cataract extraction, which case responded promptly to ether applications.

Ray K. Daily.

Leopold, I. H. *Keratoconus posticus circumscriptus*. Arch. of Opth., 1943, v. 30, Dec., pp. 732-734.

Two types of abnormal curvature of the posterior surface of the cornea have been described. One form is called keratoconus posticus and is characterized by a perfectly regular curvature, but with unusually short radius, for the entire posterior surface. The other form, called keratoconus posticus circumscriptus, consists of a localized area of increased curvature. In each type the anterior corneal curvature is perfectly regular and the abnormality is the result of thinning of the posterior corneal layers.

A case of this circumscribed lesion is reported in a Negress of 36 years. The left cornea showed an oval opacity below and nasal to the pupillary zone. Slitlamp examination disclosed that the cornea was only about one half the normal thickness in this area and that the thinning was confined to the posterior layers. The eye showed no other evidence of disease and no sign of trauma. The best vision obtained with correction was 6/30. The patient stated that the vision of this eye had always been poor, and no history of injury or disease could be elicited. The author summarizes the findings in three cases previously described by other observers. (Two illustrations, references.)

John C. Long.

Philpot, F. J., and Pirie, A. Riboflavin and riboflavin adenine dinucleo-

tide in ox ocular tissues. Biochem. Jour., 1943, v. 37, July, pp. 250-254.

To help explain the sensitiveness of the cornea to riboflavin deficiencies, ox eyes were examined separately by microbiological estimations and by the d-amino oxidase technique. The results were much alike. By either method the riboflavin content of the vitreous, lens, aqueous, and corneal stroma was found quite low, but that of the ocular conjunctiva and corneal epithelium was much higher, about 2 mg. per 100 gm. of total flavin. The higher content of the lacrimal glands, 6.5 mg. per 100 gm., and of the meibomian glands, 4 mg. per 100 gm., suggests that a part of the riboflavin content of the corneal epithelium comes from the tears and the meibomian secretion. This is of interest because in riboflavin deficiency advancement of limbal blood vessels on to the cornea may occur or may be hastened if the deficiency is not made up from the secretions of the lacrimal and meibomian glands.

Charles A. Bahn.

## 7

### UVEAL TRACT, SYMPATHETIC DISEASE AND AQUEOUS HUMOR

Duke-Elder, S., and Davson, H. The significance of the distribution ratios of nonelectrolytes between plasma and the intraocular fluid. Brit. Jour. Opth., 1943, v. 27, Oct., pp. 431-434.

The authors take issue with the statement of Kinsey and Grant (Amer. Jour. Opth., 1943, v. 26, July, p. 781) that at equilibrium the concentrations of the substance considered, electrolyte or nonelectrolyte, will not be equal in both fluids when there is a flow of aqueous humour away from the anterior chamber by some drainage channel, namely Schlemm's Canal. The fal-

lacy of this statment is proved mathematically by the second law of thermodynamics, which states that a system of this kind can only be maintained at a nonequilibrium position by the continued performance of work on it. Drainage of fluid away from the anterior chamber is not capable of performing the necessary work on the system, so that in the absence of secretory activity the concentration changes claimed are excluded by the law referred to. (References.)

Edna M. Reynolds.

Ford, Rosa. Iridocyclitis and chorioiditis due to "silent" sinusitis. *Brit. Jour. Ophth.*, 1943, v. 27, Oct., pp. 469-471.

Five cases of iridocyclitis and chorioiditis due to silent sinusitis are reported. The author recommends that, if all investigations prove negative in a case of uveitis, latent sinusitis, giving no sign of its existence except its remote toxic effects, be suspected and treated. (References.)

Edna M. Reynolds.

Garrow, A., and Lowenstein, A. Calcification in a hydrophthalmic eye. *Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, pp. 189-197. (See Section 8, Glaucoma and ocular tension.)

Louria, Milton. Tuberculous adenitis with iridocyclitis. *Quarterly Bull. Sea View Hosp.*, 1942, v. 7, Oct., pp. 444-447.

A 14-year-old schoolboy had fever, swollen glands in the groin, swelling of the eyelids, disturbance of vision, and a rash on the legs. There were frequent drenching sweats, particularly at night, and the temperature ranged from 101 to 104 degrees. The ocular diagnosis was of bilateral iri-

docyclitis, and both this and the inguinal adenitis were attributed to tuberculosis of an acutely disseminated character. There were a number of adhesions of the iris to the anterior lens capsule, with many large spots on the posterior surface of the cornea. Excised inguinal nodes showed tuberculosis. After a positive skin reaction with a 1-to-10,000,000 dilution of tuberculin (bacillary emulsion); the patient was placed on tuberculin therapy. In ten weeks the body weight had increased from 128 to 163 pounds, and almost all the ocular and other symptoms had disappeared, with recovery of vision of 20/20 in each eye. The author feels uncertain how much credit should be given to the tuberculin therapy.

W. H. Crisp.

Lowenstein, O., and Givner, I. Pupillary reflex to darkness. *Arch. of Ophth.*, 1943, v. 30, Nov., pp. 603-609.

In 1939 Lowenstein described a pupillary reflex which he called the "reflex to darkness." In order to elicit this reflex both eyes of the subject tested are adapted to a constant level of illumination in which darkness is a periodic stimulus. The resulting movements of the pupils are recorded by pupillography. The phenomenon consists of primary dilatation followed by the second phase of contraction and secondary redilatation.

The authors state that the reflex to darkness is frequently more susceptible to the influence of pathologic conditions than is the reflex to light. In a patient operated on for pinealoma, dissociation between the reflexes to light and to darkness was observed. The former were practically absent, and the latter were exaggerated. This dissociation of pupillary reflexes suggests the existence of separate pathways for the



reactions to light and to darkness. The authors believe that there must exist at least one point in the brain where the pathways of the reflexes to light and to darkness are not identical. (6 figures, references.)

R. W. Danielson.

Riddell, W. J. Iris color changes in middle life. *Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, pp. 183-187.

The author classified the color of the iris according to (1) the general color (blue, gray, green, yellow, tan, and chocolate), (2) the presence or absence of diffuse color, and (3) the presence or absence of spots or little masses of color. A series of 500 patients, 220 males and 280 females, were coded by this method. It was shown that the different classes were not homologous in respect to sex.

The changes in eye color seem to occur regularly during adult life, and to occur much earlier in women than in men. The changes tend generally to range from a class containing an excess of men to one containing an excess of women, and from the more masculine or juvenile classes to the more feminine or senile classes. (2 tables, references.)

Beulah Cushman.

Scobee, R. G., and Slaughter, H. C. Endophthalmitis phaco-anaphylactica. *Amer. Jour. Ophth.*, 1944, v. 27, Jan., pp. 49-52. (2 illustrations, 1 table, references.)

8

GLAUCOMA AND OCULAR TENSION

Benedict, W. L. The surgical treatment of glaucoma. *Pennsylvania Med. Jour.*, 1942, v. 45, Aug., pp. 1167-1172.

The various surgical procedures in

general use are briefly reviewed, with some indication as to the type of case suitable for each operation.

W. H. Crisp.

Boyd, J. L. Quantitative comparison of methods of administering physostigmine. *Arch. of Ophth.*, 1943, v. 30, Oct., pp. 521-525.

Physostigmine was applied to the eyes of albino rabbits by several different methods and the concentration of the drug in the aqueous was then determined by bioassay on white mice. It was found that application of a 0.25-percent physostigmine-salicylate ointment gave a higher concentration in the aqueous humor than instillation of a 0.5-percent solution in distilled water. A lamella containing 0.11 mg. of physostigmine salicylate was twice as efficient as the ointment. A 0.5-percent physostigmine sulphate solution in a water-soluble jelly and a similar solution containing a wetting agent each produced a concentration in the aqueous approximating that produced by the lamella. The wetting agent, zephiran, is incompatible with salicylates, so physostigmine sulphate was used in these experiments. Iontophoresis employing a 2-ma. current for two minutes, with a 0.1-percent aqueous solution of physostigmine salicylate, increased the concentration  $3\frac{1}{2}$  times that obtained by instillation of 0.5 percent physostigmine sulphate with a wetting agent. Four instillations of a 0.5-percent physostigmine-sulphate solution containing zephiran gave a concentration twice that obtained by four instillations of a 0.5-percent aqueous solution but less than half that obtained by iontophoresis with a 0.1-percent aqueous solution and a current of 2 ma. for two minutes. (References.)

John C. Long.

Freiman, George. **Clinical study and review of tonometry.** *Arch. of Ophth.*, 1943, v. 30, Oct., pp. 526-546.

This is a detailed discussion of the principles and instruments involved. Direct manometry is the only scientifically accurate method of measuring the true intraocular pressure. As this is clinically impractical, all methods of tonometry involve indirect calculations based on the incompressibility of the globe.

The Schiötz instrument is discussed in great detail, comparing this instrument with the McLean among others. Schiötz insisted that measurements be recorded in terms of the scale-reading with the particular weight used, rather than in millimeters of mercury. Recording in millimeters of mercury gives the impression of a degree of scientific accuracy that is not yet attainable. The McLean instrument is essentially a modification of the Schiötz type. It differs mainly in that (1) the scale is inverted so that it can be read close to the patient's eye, (2) the weight is constant, and (3) the instrument is read directly in millimeters of mercury. The author reports a series of 410 measurements with the Schiötz and McLean tonometers, giving a comparison of their readings. Adler, Berner, and Meyer had reported that the Schiötz, McLean, and Gradle instruments were sufficiently accurate for clinical purposes. The Bailliart and Souter tonometers differ from any of the above in that the pressure is applied to the eye by a spring rather than by gravity. Each of these instruments is found valuable by some workers.

Attention is called to the inaccuracy with which some of the tonometers are made. A wide variation has been found in the weight and construction of Schiötz instruments. In recognition of

the need for standards in construction, the American Academy of Ophthalmology and Otolaryngology has appointed a Committee on Standardization of Tonometers. (2 tables, references.)

John C. Long.

Garrow, A., and Lowenstein, A. **Calcification in a hydrophthalmic eye.** *Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, pp. 189-197.

The author reports a case of monocular hydrophthalmos because of its possible relationship to the group of congenital anomalies known as phacomatoses (birth marks) and particularly to Sturge Weber's disease. In that disease hydrophthalmos is associated with nevus flammeus of parts supplied by the trigeminal nerve and convulsive symptoms indicative of changes in the cerebral blood vessels.

The patient was ten years old when the right eye was removed. She had been first seen at the age of 3½ years with a history of having had the large eye for one year. The tension varied between 40 and 60 mm. Schiötz until after a trephining during the first year of observation, when the tension became and remained subnormal. Three years later the eye became irritable, and it was so at intervals until still three years later it began to shrink and so was removed.

The cornea contained many blood vessels and blood was present in the substance of the cornea. Descemet's membrane was folded and one rupture found. The anterior chamber was densely packed with connective tissue, and a wavy piece of Descemet's membrane was found embedded in this connective tissue. The anterior capsule of the lens was folded and formed a wavy uninterrupted line. There was a broad layer of subcapsular organized exudate.

Degenerated lens substance was found to be freely sprinkled with lime. Fibrinous exudate was present in front of and behind the choroid, and the ciliary body and choroid were separated from the sclera. Fluid infiltration had divided the ciliary body into bundles. The choroidal separation from the sclera seemed to be associated with the fluid effusion, and there was also a large subretinal effusion.

Around the optic nerve there was an overgrowth of blood vessels resembling an angioma, and covered by a sheet of connective tissue. Another mass of vascular spaces was found at the anterior boundary of the retina. The calcification of vessels of the angioma was not uniform.

The retinal tissue and blood vessels were heavily impregnated with lime, and there were varying degrees of calcification of the retinal blood vessels. Some ganglion cells of the retina were also calcified. (8 illustrations.)

Beulah Cushman.

Schoenberg, M. J. The technique of tonometry and care of tonometers. *Amer. Jour. Ophth.*, 1944, v. 27, Jan., pp. 70-71.

Swan, K. C. Carbaminoylcholine chloride in petrolatum. *Arch. of Ophth.*, 1943, v. 30, Nov., pp. 591-592.

Carbaminoylcholine chloride is a synthetic drug introduced in 1932 as a long-acting substitute for acetylcholine. Inasmuch as the drug produces miosis and cyclotonia and decreases intraocular pressure, it is used as an agent in the treatment of glaucoma.

The drug has a high affinity for water and a low affinity for lipids. Like other substances with these properties, it penetrates the normal human and rabbit cornea more readily when ad-

ministered as a suspension in a pure olive-oil or petrolatum base than when given in a simple aqueous solution or in one containing zephiran chloride or in ointment bases containing hydrous wool fat.

Clinical experiments were made on a group of 15 eyes (nine patients) with chronic noncongestive glaucoma. Pilocarpine administered three or four times daily was ineffective in controlling the tension or in preventing visual loss. Carbaminoylcholine chloride (1.5 percent in 0.03-percent solution of zephiran chloride) administered three to four times daily was effective in keeping the tension below 30 mm. Hg (Schiötz) and in preventing loss of visual field in 11 of the 15 eyes during periods of five months up to three years. However, carbaminoylcholine chloride (1.5 percent) in petrolatum administered only twice daily was equally effective in controlling the tension in these eleven eyes. In two eyes the tension was not consistently controlled by carbaminoylcholine chloride in solution of zephiran chloride when the drug was administered at home three to four times daily, whereas administration of the ointment twice daily at home was successful. (References.)

R. W. Danielson.

## 9

### CRYSTALLINE LENS

Falls, H. F., and Cotterman, C. W. Genetic studies of ectopia lentis. *Arch. of Ophth.*, 1943, v. 30, Nov., pp. 610-620.

The present report on the inheritance of ectopia lentis is based on the study of a single genealogical tree displaying this relatively rare ocular anomaly. The pedigree includes six generations, in which 157 individuals were examined.

Twenty-four with ectopia lentis were observed, five as judged by the history were probably affected, and two unaffected members were regarded as gene carriers.

The pedigree of ectopia lentis displays dominant inheritance of the anomaly. No conspicuous associated anomalies of the iris, cornea, or pupil were observed. Cataractous changes were common sequelae of the dislocation of the lenses. Chronic noninflammatory glaucoma and secondary glaucoma were frequently noted. Anthropometric measurements taken on all members of this pedigree failed to indicate any association between ectopia lentis and the length of the extremities, such as is found in the syndrome of arachnodactyly. To a considerable degree ectopia lentis adversely affects the physical and mental well-being, the educational achievement, and the economic status of the affected person.

The authors give a résumé of the surgical approach and emphasize that surgical intervention in the treatment of ectopia lentis is a serious and dangerous undertaking. The "treatment" is, of course, preferably prophylactic. (2 figures, references.)

R. W. Danielson.

Fortin, E. P. Considerations on the lens. *Arch. de Oft. de Buenos Aires*, 1942, v. 17, May, p. 297.

From the appearance of numerous histologic preparations of animal and human ocular tissues, the author speculates (1) as to a hitherto unknown function of the iris, consisting of wiping the anterior lens capsule in a fashion similar to the action of an automobile windshield-wiper; (2) on the architecture of lens fibers and the existence of the zonule; and (3) on the na-

ture of presbyopia and the mechanism of accommodation. The article, which is profusely illustrated, does not lend itself to abstracting.

Plinio Montalván.

Scobee, R. G., and Slaughter, H. C. Endophthalmitis phaco-anaphylactica. *Amer. Jour. Ophth.*, 1944, v. 27, Jan., pp. 49-52. (2 illustrations, 1 table, references.)

Smith, S. E., and Barrentine, B. F. Hereditary cataract. *Jour. of Heredity*, 1943, v. 34, Jan., p. 8.

The authors report the presence of cataract in albino rats, starting a few days after birth and becoming completely mature within a few days. No definite cause for the lens changes could be given. Dietary deficiency was probably not responsible, since all the rats were maintained on an adequate stock diet.

F. M. Crage.

## 10

### RETINA AND VITREOUS

Ballantyne, A. J. The ocular manifestations of spontaneous subarachnoid hemorrhage. *Brit. Jour. Ophth.*, 1943, v. 27, Sept., pp. 383-414. (See Section 12, Visual tracts and centers.)

Drews, L. C., and Minckler, J. Massive bilateral preretinal type of hemorrhage associated with subarachnoidal hemorrhage of brain. *Amer. Jour. Ophth.*, 1944, v. 27, Jan., pp. 1-15. (8 illustrations, references.)

Knapp, Arnold. Peripheral retinal holes without detachment. *Arch. of Ophth.*, 1943, v. 30, Nov., pp. 585-590.

The author reviews the literature and reports five cases showing peripheral retinal holes without detachment. It is believed that the lack of detachment even in the presence of a hole is

due to formation of chorioretinal adhesions and to the fact that for some reason the usual factors in the production of detachment have not become operative. Knapp reviews the usual causes of detachment, such as gravity and adhesions, and liquefaction and movement of the vitreous. The non-development of a retinal detachment may be due to absence of any one of these factors.

As for treatment, the patient should, of course, be kept under observation. Some authors believe surgery is indicated, but Knapp does not favor it. At any rate, if surgery is attempted some very simple procedure should be used. (References, 1 figure.)

R. W. Danielson.

Lindsay-Rea, R. *Technique of retinal-detachment operations*. Trans. Ophth. Soc. United Kingdom, 1942, v. 62, pp. 277-284.

The author describes the method with which he has obtained good results in the operative care of retinal detachment. Retrobulbar injection is used and the cornea is kept clear for use of the ophthalmoscope during the operation. A fine needle with thread is passed through the sclera at a point corresponding to the meridian in which the tear is situated. This is used in turning the eyeball. The position of the tear is marked with India ink. In this region a bent catholysis-needle is inserted, and the fundus is then examined. If the needle is not at the tear it is to be reinserted. Upon localization a barrage of diathermy micropunctures is made around the area. Glass or ivory retractors should be used. A continuous fine catgut suture is used to close the conjunctiva. The eye is examined one week later. The retina is usually found replaced by two or three weeks later.

Pinhole spectacles are then put on and plenty of light admitted to the room. The patient is allowed up at the end of three or four weeks and the pinhole spectacles are used two weeks longer. (7 illustrations.) Beulah Cushman.

Lloyd, J. P. F. *Subhyaloid hemorrhage following "T. A. B." inoculation*. Brit. Jour. Ophth., 1943, v. 27, Oct., p. 461.

A case of extensive subhyaloid hemorrhage in front of the macula is reported following routine immunization with T.A.B. (typhoid-paratyphoid). Vision was reduced to hand movements. It had not improved a month later, although the retinal vessels could be seen through the vitreous haze. After an interval of two months, there was still considerable unabsorbed hemorrhage in the vitreous.

Edna M. Reynolds.

Mutch, J. R., and Mackay, D. *The detection and significance of melanophore expanding substance in urine and blood with special reference to retinitis pigmentosa*. Brit. Jour. Ophth., 1943, v. 27, Oct., pp. 434-449.

Vertebrates show two striking examples of pigment migration. One is migration of pigment within the skin melanophores of cold-blooded vertebrates. The other is migration of the retinal pigment in amphibia and fish in response to varying light intensity.

It is well established that the skin-melanophore response is mediated by a melanophore-dispersing hormone (B hormone) secreted by the intermediate lobe of the pituitary. Mammals, including man, have no skin melanophores like those in amphibia and fishes. Yet the pituitary glands in mammals are rich in B hormone or a substance with similar action. Extracts from the hypo-

thalamus, the eye, blood, aqueous humor, cerebrospinal fluid, urine, and colostrum also show the presence of B hormone.

The only cells in mammals which might be comparable to the skin melanophores of amphibia and fish are the retinal pigment cells of the eye. B hormone might therefore mediate changes in the pigmented layer of the retina. Experiments to date have not proved that B hormone plays any physiologic role in vision. There are no data to indicate the role of B hormone in pathologic conditions such as retinitis pigmentosa.

It was the recognition of retinitis pigmentosa as a feature of the Laurence-Moon-Biedl syndrome which first prompted the idea that the latter disease might be associated with diencephalic and endocrine disturbances. Dax, by his demonstration that urine samples from 20 retinitis pigmentosa patients when injected into frogs expanded the skin melanophores (*Amer. Jour. Ophth.*, 1938, v. 21, p. 1198, and 1939, v. 22, p. 572) led to renewed interest in the interpretation of retinitis pigmentosa as an endocrine or diencephalic disturbance.

The most widely accepted theory of the etiology of retinitis pigmentosa is that the degeneration of the neuroepithelium is primary and the vascular sclerosis secondary. Another theory is that it is due to an endocrine disturbance. The abnormal hormonal influences are believed to arise from a congenital lesion in the pituitary-hypothalamic system. The presence of a melanophore-expanding substance in the urine of retinitis-pigmentosa patients is considered particularly significant.

Experiments are reported in which blood samples from nine retinitis-pig-

mentosa patients were assayed and compared with blood samples from seven normal controls. Details are given of the process of extraction and assay employed. Only three of the nine retinitis-pigmentosa samples were definitely positive, and two of the seven control samples gave a positive result. It is concluded that the blood of retinitis-pigmentosa patients does not regularly contain a melanophore-expanding substance, and that such a substance may occasionally be present in normal bloods.

A further experiment is described to show that in the rabbit the B hormone, injected intravenously, disappears very rapidly from the circulation. (3 tables, references.) Edna M. Reynolds.

Post, L. T., and Sanders, T. E. Temporal arteritis. *Amer. Jour. Ophth.*, 1944, v. 27, Jan., pp. 19-25; also *Trans. Amer. Ophth. Soc.*, 1943, v. 41. (3 illustrations, references.)

Steven, D. M. Experimental human vitamin-A deficiency. The relation between dark adaptation and blood vitamin-A. *Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, pp. 259-275.

The author has attempted by experiments to discover whether there is any correlation between poor dark-adaptation or night blindness and low values of blood vitamin-A. Previous experiments have presented evidence that for each individual there is a critical level of blood vitamin-A below which dark adaptation begins to show impairment, this being an individual characteristic which may differ greatly in different persons.

For the experimental work the author kept volunteers on a controlled diet deficient in the one factor he wished to investigate.

After pooling the findings in nine subjects he comes to the conclusion that all cases of night blindness which show blood vitamin-A values above 75 i.u. per 100 ml. of plasma are unlikely to be of nutritional origin. In six individuals a high degree of correlation was found between the rise of the visual threshold and the fall of the blood-vitamin-A level. (6 figures, 3 tables, references.)

Beulah Cushman.

# 11

## OPTIC NERVE AND TOXIC AMBLYOPIAS

Adrogué, E., and Insausti, T. Etiology of papilledema. *Arch. de Oft. de Buenos Aires*, 1942, v. 17, May, p. 285.

The authors record in tabulated form 140 cases of papilledema studied during the last four years. Table no. 1 contains the findings, diagnosis, and localization in each case. Table no. 2 is a résumé of table no. 1. Table no. 3 presents the etiology of every case in this series. Table no. 4 records the intra-ventricular pressure. In three subtables are presented the clinical data concerning the cases of unilateral papilledema, those with bilateral papilledema more marked on one side, and those in which the papilledema was equal in both eyes. The article does not lend itself to abstracting.

Plinio Montalván.

Astakhova, A. P. The action of anti-freeze on the eye. *Viestnik Oft.*, 1943, v. 22, pt. 2, pp. 33-35.

The author examined ophthalmoscopically thirty patients poisoned with anti-freeze. In six fatal cases directly due to heart and circulatory failure, the retina was cyanotic. In five fatal cases, because of secondary degeneration of the internal organs, the fundus veins

were dilated. There was one case of optic neuritis and one of pale discs. In 17 cases the fundus was normal. The conclusions are that anti-freeze is a neurovascular poison, with no predilection for the optic nerves.

Ray K. Daily.

Montgomery, E. C. Intraocular neuritis. *Jour. Iowa State Med. Soc.*, 1943, v. 33, July, p. 298.

Two children, ten and twelve years old, had acute intraocular neuritis. In the older child after sulfadiazine therapy and tonsillectomy, the neuritis subsided within 11 months with 20/20 vision, but a peripheral visual-field contraction remained. In the younger child, under the same therapy, vision returned to 20/20 after two months. In view of the relationship of optic neuritis to disseminated sclerosis, the author believes that during the next few years these patients should be watched for neurologic symptoms.

T. M. Shapira.

Potter, W. B. Visual impairment during tryparsamide therapy. *Arch. of Ophth.*, 1943, v. 30, Nov., pp. 669-687.

This review of the literature points out that, while tryparsamide is considered one of the best drugs in the treatment of neurosyphilis, unfortunately many cases of damage to the visual system have been reported after its use. Elucidation of the process, and of the character and frequency, of untoward visual effects from tryparsamide has remained incomplete.

The associated ocular problems lend themselves to general outline as follows: (1) as to the ocular effects of tryparsamide when syphilitic disease of the optic nerve preëxists; (2) as to the designation of lesions according to whether the damage to the retina or



optic nerve results primarily from syphilis, from the use of the tryparsamide, or from the fact that the tryparsamide was used during a period of involvement, inactive or active, of the optic nerve in a syphilitic process (Jarisch-Herxheimer reaction); (3) as to evaluation of the objective and subjective findings with regard to modification of tryparsamide therapy; (4), as to evaluation of factors related to individual dosage, number of injections, and subsequent series of injections; (5) as to the nature of the reaction to tryparsamide from the visual aspect; (6) as to the nature of the tryparsamide reaction from the pathologic aspect.

On all of these problems there is a difference of opinion among investigators and clinicians. Only a few of the statements and conclusions can be given. The drug is contraindicated except in the treatment of neurosyphilis, for which it is usually employed after six months of preliminary treatment with arsphenamine. The usual dose is 3 gm. intravenously. A minimum course consists of 12 weekly injections, although more prolonged use of the drug is ordinarily productive of better results. Primary atrophy of the optic nerve is the most frequent sort of neuropathy and is most frequently due to syphilis. Several authors have noted that there is no relationship, either qualitative or quantitative, between the appearance of the nerve head and the functional capacity of the nerve. Not all atrophy of the optic nerve occurring when the serologic reactions are positive is of the primary type; other changes in the oculonervous pathway may be at fault. Atrophy of the optic nerve cannot always be designated as primary or secondary on the basis of ophthalmoscopic examination alone. In optic-nerve atrophy, changes in the

fields usually occur previous to pallor of the optic disc.

There appears to be no evidence that sex, race, or age of patient is related to untoward visual effect during therapy with tryparsamide. A medicolegal case is reported where the patient won a suit on the ground that tryparsamide therapy was continued in spite of the plaintiff's complaint of increasing visual disturbances. Opinion seems equally divided between those physicians who when primary syphilitic optic-nerve atrophy is present would withhold the drug and those who under similar conditions would favor its use.

That the differential diagnosis between the normal appearance of the optic disc and that of primary syphilitic optic-nerve atrophy is not always clearly defined is attested by the fact that the color of the disc, the visual acuity, and the visual-field findings may yield contradictory evidence. But examination of the visual fields seems to offer the most effective information in regard to the exact basis of impairment of vision.

Suggestions to explain visual involvement include a hypothetic toxic effect of the drug on the nerve or retina, idiosyncrasy to the drug, factors superimposed by drug therapy on active syphilitic involvement (reactivation of a process) and the Jarisch-Herxheimer reaction. Problems such as the valence of the arsenic in the preparation, the structure of the tryparsamide molecule, and the factors of excretion and metabolism have been considered without establishment of conclusive opinions. (Bibliography.) R. W. Danielson.

Turner, J. W. A. Indirect injuries of the optic nerve. *Brain*, 1943, v. 66, June, pp. 140-151.

The author's study is based on 46 cases of indirect optic-nerve injury and excludes direct involvement by a projectile. These cases represent approximately 1.5 percent of 3,250 head-injury patients observed in two English head-injury centers. Included are falls, air-raid casualties, bicycle and motor-cycle accidents, accidents to pedestrians, car and lorry accidents, and miscellaneous.

In 35 cases, the impact was on the forehead or supraorbital region and on the same side as the visual loss; in six cases, the impact was in the region of the external angular process. In only one case was there a posterior head injury, and a contrecoup from an occipital injury was never observed to damage the optic nerve. The effect on vision was immediate and no delayed blindness was observed. Visual improvement, if it occurs, usually begins about the third day, rapidly progresses, and terminates about the fourth week. The prognosis of optic-nerve injuries is worse than that of injuries to other cranial nerves. The final corrected visual acuity in these 46 cases was: 6/60 or less, 23; 6/18 to 6/60, 21; better than 6/18, 14 cases. Visual fields included 8 cases with scotoma, pericentral, paracentral, and centrocecal, as the dominant feature. In 19 cases the defect was predominantly in the peripheral field, and in 19 cases the field changes were apparently mixed. In the severe cases disc pallor was usually first noted about the end of the third week, whereas in the less severe cases it occurred somewhat later. In severe injuries the pupils were equal, the pupil of the affected side showing a sluggish or no reaction directly, but giving a brisk consensual reaction. Pupillary inequality occurred only if third-nerve injury was coincidental. In only four cases was any abnormality found in the

optic canal by X ray. The author believes that the dominant pathologic lesion was a hemorrhage or thrombosis in the intracranial part of the optic nerve. Violent impingement against the bony wall of the canal ruptures small vessels in the septa of the nerve, with secondary local thrombosis and softening. Charles A. Bahn.

## 12

### VISUAL TRACTS AND CENTERS

Balado, Manuel. *Retinal areas and cortical sectors*. Arch. de Oft. de Buenos Aires, 1942, v. 17, May, p. 250.

The author discusses the difference between the campimetric findings in lesions of the occipital cortical area and those involving the nerve-fiber bundles at their entrance to the globe, such as seen in glaucoma, toxic amblyopia, and juxtapapillary chorioretinitis. In the latter group of diseases the scotomata do not follow the vertical and oblique meridians of the visual field; whereas in the field defects produced by lesions situated in the cortical area the vertical meridian passing through the center of the fovea always divides the visual field into two halves, a blind half and a seeing half. The anatomical basis is explained. (Illustrations.)

Plinio Montalván.

Ballantyne, A. J. *The ocular manifestations of spontaneous subarachnoid hemorrhage*. Brit. Jour. Ophth., 1943, v. 27, Sept., pp. 383-414.

Five cases of nontraumatic subarachnoid hemorrhage are reviewed and the pathological findings are given in detail because of their bearing on the nature and origin of the ocular complications. Hemorrhages varied in distribution in each case but were widely distributed between the sheaths of the optic nerve,

in the orbit among the fat and muscles, surrounding the posterior ciliary nerves, ciliary ganglion, ophthalmic and posterior ciliary arteries, and around the vessels of the chiasm and optic tracts, as well as beneath the retina in all its layers, in front of the retina, and in the vitreous. Serial sections showed that the hemorrhages were not in continuity but were discrete and independent.

The author reviews the various theories which have been advanced as to the source of the blood found within the sheaths of the optic nerve and in the retina. Because he finds hemorrhages occurring simultaneously in so many other areas beside the optic nerve, the retina, and the vitreous, it is his opinion that such multiple hemorrhages can only be explained by a sudden rise of intracranial pressure causing stasis in all the venous channels which drain the tissues of the eye and the contents of the orbit. He suggests also that some of the clinical signs of subarachnoid hemorrhage, such as oculomotor paresis and disturbance of the conjugate movements of the eyes, may be explained by the occurrence in the mid-brain of hemorrhages similar to those found in the chiasm and optic tracts in one of the cases reported here. (31 illustrations, references.)

Edna M. Reynolds.

Clark, W. E. L. The anatomy of cortical vision. (Doyle Memorial Lecture.) Trans. Ophth. Soc. United Kingdom, 1942, v. 62, pp. 229-245. (See Section 19, Anatomy, embryology, and comparative ophthalmology.)

Fetter, W. J. Subarachnoid hemorrhage. Pennsylvania Med. Jour., 1943, v. 46, June, p. 949.

The author reviews a series of 68

cases of subarachnoid hemorrhage hospitalized during a five-year period. He states that this disturbance occurs most frequently in cases of trauma, intracranial aneurysm, and arteriosclerosis. The abrupt onset of symptoms, signs of meningeal irritation, and the finding of an evenly blood-stained spinal fluid are characteristic. Prognosis is less favorable in hypertensives. As a rule, conservative treatment is the most satisfactory. T. M. Shapira.

Orton, S. T. Visual functions in strephosymbolia. Arch. of Ophth., 1943, v. 30, Dec., pp. 707-711.

Children who make little progress in learning to read are quite naturally referred to the ophthalmologist. Many, however, if not the majority of these children have adequate vision and in reality present neurologic problems. Three distinct levels of elaboration may be recognized in cases of absence of visual functions normally acquired in early life. Disturbances at these levels are recognized respectively as cortical blindness, mind blindness, and word blindness. It is thought that only at the third level does the principle of bilateral dominance apply, and there is reason to believe that at this level the records in the two hemispheres are opposite in sign, and that one record must be omitted to prevent confusion.

In studying children with reading defects the author was struck by the inability of children to differentiate "b" from "d" and "p" from "q," and by their tendency to read many words from right to left instead of in the usual direction. Some of these children showed an unexpected facility in reading mirrored print and some also were skilled in mirror writing. The author suggests that these deviations are due to failure to acquire the normal adult

pattern of complete dominance by one hemisphere of the brain. The author further offers the term "strephosymbolia," or "twisting of symbols," as being less misleading than the older term, "congenital word blindness."

The relationship between eyedness and handedness is discussed in connection with reading defects. From the data collected the author concludes that children showing the strephosymbolia syndrome represent intergrades between right-sided and left-sided familial tendencies and that the reading disability follows fairly definite hereditary trends. It is interesting to note that such reading difficulties occur much more frequently in boys than in girls. (2 figures.) John C. Long.

Scheneley, W. G., Jr. Clinical approach to vertigo. *Dis. Eye, Ear, Nose, and Throat*, 1942, v. 2, July, pp. 198-201.

In question-and-answer form the author explains and illustrates the relationships which exist between vertigo and the organs of orientation, namely, the eyes, the semicircular canals, the ventriculus, the utricles of the middle ear, and the joints, muscles, and viscera. Vertigo following paralysis of the extraocular muscles does not last so long as that caused by paresis of these muscles. Aural vertigo is always associated with rhythmic nystagmus, the direction of which depends on the direction of the semicircular canal involved. The anatomic relationships and pathology of rhythmic nystagmus are explained at some length, as are galvanic rotational and caloric tests. Undulatory nystagmus caused by visual defects, either congenital or acquired early, especially of the central visual mechanism, is seldom associated with vertigo.

Charles A. Bahn.

Turner, J. W. A. Indirect injuries of the optic nerve. *Brain*, 1943, v. 66, June, pp. 140-151. (See Section 11, Optic nerve and toxic amblyopias.)

### 13

#### EYEBALL AND ORBIT

Inciardi, J. A. Unilateral exophthalmos. *Dis. Eye, Ear, Nose, and Throat*, 1942, v. 2, Dec., p. 359.

The more important causes of unilateral exophthalmos are classified. Each type is described, in order that the ophthalmologist may be aided in finding the etiologic factor concerned. The author gives detail of diagnosis and treatment in many types of this condition.

F. M. Crage.

Sverdlov, D. G. Spectacles with shields for hiding defects in and about the orbit. *Viestnik Oft.*, 1943, v. 22, pt. 2, p. 47.

The author urges the use of an opaque lens and a shield, instead of a bandage, to cover loss of tissue in and about the orbit. The shield may be made of any plastic material, and colored to match the spectacle frame. The advantages claimed for this device are elimination of irritation, especially in warm weather, accessibility of air to the skin and wound, and a more agreeable cosmetic impression. (One illustration.)

Ray K. Daily.

### 14

#### EYELIDS AND LACRIMAL APPARATUS

Dodds, G. E. A case showing partial deficient fusion of a maxillary process with lateral nasal process on one side. *Brit. Jour. Ophth.*, 1943, v. 27, Sept., pp. 414-415.

The patient had distortion of the right nostril with a hiatus showing the interior of the nose. This was merely

a cleft in the cartilaginous part of the nose, and the bony structure appeared normal. There was notching of both upper eyelids at the junction of the inner third with the outer two thirds of the lid. On the inner side of the left medial canthus, there was a blind shallow pit in the skin of the nose. Conduction of tears appeared normal and the eyes were normal. (One illustration.)

Edna M. Reynolds.

Hague, E. B. Recent advances in eyelid surgery. *Dis. Eye, Ear, Nose, and Throat*, 1942, v. 2, Dec., p. 353.

The article outlines the basic principles of surgery in the region of the eye and describes some relatively new procedures used in correcting ptosis, spastic entropion, and blepharopoesis. In late plastic lid-repair the author joins Dunnington and Wendell Hughes in decrying the use of the pedicle grafts because they create new deformities. Instead free grafts are recommended. Special emphasis is laid on type of sutures and their removal, and the technique of dressings. F. M. Crage.

Lewis, S. J. Aneurysm in eyelid. *Jour. Med. Assoc. Georgia*, 1943, v. 32, June, p. 185.

A luetic 19-year-old colored female had an aneurysm of the upper eyelid, diagnosed clinically by a palpable thrill synchronous with the pulse. At operation under general anesthesia the palpebral branch of the ophthalmic artery showed an aneurysm, which was ligated. Severe proptosis and chemosis followed, but at operation subsided.

T. M. Shapira.

Paula Santos, B. Phenomenon of Marcus Gunn. *Arquivos Brasileiros de Oft.*, 1943, v. 6, June, pp. 68-98.

As a preliminary, the author calls

attention to the distinction between the phenomenon of Marcus Gunn (the jaw-winking phenomenon) and the Marcus Gunn sign (pressure by a retinal artery upon the vein at a crossing). The greater part of this 31-page article is occupied with a restatement of what the author describes as the most complete work on the Marcus Gunn phenomenon, the paper by H. Villard which appeared in the *Bulletin of the French Society of Ophthalmology*, 1935, pages 725-755.

From a survey which Paula Santos suspects of being not altogether complete, he estimates that the world literature of the subject records more than 149 cases. A four-page bibliography is appended.

The single new case now recorded is that of a seven-year-old Brazilian boy. His parents had no trace of consanguinity. There had been six children, five of which survived, and none of which showed organic anomalies. No case of palpebral ptosis was recorded in the ascendants. The behavior of the affected eye is shown by four excellent photographs, with various positions of the lower jaw.

The right eye had normal visual acuity, the left only  $\frac{1}{8}$ . The affected eye had a hyperopia of 2 D., correction of which did not improve vision. There was paralysis of the left superior rectus muscle, so that the eye had limited upward motion.

Lowering of the mandible was accompanied by elevation of the left upper lid, the elevation being proportionate to the amount of opening of the mouth. A similar effect upon the eyelid was produced by lateral movements of the jaw, the elevation being more marked when the jaw was drawn to the opposite side. Lid elevation also occurred during loud speaking or

shouting. It was not elicited by whistling, swallowing, or backward inclination of the head. The ptosis could not be corrected voluntarily, but contraction of the frontal muscle induced an increase in the palpebral fissure.

The etiology of the anomaly is entirely unknown. The author considers various speculative theories. It has been suggested that the nucleus of the lid elevator and the upper end of the masticating nucleus might be anatomically united; but this idea is embryologically untenable, because the two nuclei have distinctly different locations in the brain. Terrien has pointed out that patients affected by congenital ptosis show a slight degree of the Gunn phenomenon, usually overlooked.

W. H. Crisp.

## 15

### TUMORS

Carter, L. F. Dermoid tumor of the sclera. *Amer. Jour. Ophth.*, 1944, v. 27, Jan., pp. 67-70. (3 illustrations, references.)

Foster, J. Discission of traumatic hyaloid diaphragm. *Brit. Jour. Ophth.*, 1943, v. 27, Oct., pp. 462-464.

A case is reported in which a dense fibrous membrane in the vitreous was divided with a Ziegler knife introduced behind the ciliary body from the temporal side. No diathermy of the Ziegler puncture was performed. At the first dressing an advanced posterior cortical cataract was evident. It progressed to maturity in less than a week. Two lens discissions were performed, and with correction (+13.5 D. sph.) vision of 6/5 was obtained. (3 diagrams.)

Edna M. Reynolds.

MacCallan, A. F. Tumor of conjunctiva simulating tubercle due to trachoma. *Trans. Ophth. Soc. United*

Kingdom, 1942, v. 62, pp. 79-82. (See Section 5, Conjunctiva.)

Neame, Humphrey. Two cases of malignant melanoma of the iris. *Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, pp. 103-111.

Two cases of melanotic tumor of the iris were seen almost three years after operation. One had been treated with unscreened radium after incomplete removal by iridectomy. The other had been merely removed by iridectomy. An iridectomy is indicated when the neoplasm is small, well defined, and situated near the pupillary border, with normal intraocular tension and good vision. (9 illustrations.)

Beulah Cushman.

Picena, J. P., and Páez Allende, F. Concerning an achromatic melanoma of the choroid. *Arch. de Oft. de Buenos Aires*, 1942, v. 17, May, p. 255. (See also *Amer. Jour. Ophth.*, 1943, v. 26, p. 657.)

A woman eighty years old presented a retinal detachment in a blind eye. An acute attack of glaucoma developed and the eye was enucleated. Histopathologic examination disclosed a malignant melanoma of the choroid of the so-called achromatic or nonpigmented type, and special staining methods revealed the presence of granules of melanin. From morphologic studies of the tumor cells the authors agree with Masson that melanocytes are derived from the cells of the nerve sheath of Schwann and that choroidal melanomata are, consequently, neuroectodermal in origin. (Photomicrographs, bibliography.) Plinio Montalván.

Reuling, F. H. Glioma of the optic nerve. *Jour. Iowa State Med. Soc.*, 1943, v. 33, Sept., pp. 422-424.

Glioma of the optic nerve is quite rare, there being about one such case for every two hundred choroidal melanomas. It occurs in the first decade, with gradual loss of vision, and exophthalmos. Pain is not marked. Histologically, the tumors are classified as finely reticulated, coarsely reticulated, or coarsely fibrillated types. The case of a ten-year-old boy is presented, with history of painless exophthalmos of the left eye for two years. There was no light perception, and the optic-nerve head showed marked atrophy. The eyeball and tumor were removed. The Army Medical Museum diagnosed the tumor as "glioma of the optic nerve, chiefly coarsely fibrillated type." Gross and microscopic photographs and descriptions of the tumor are included in the paper.

Benjamin Milder.

## 16

### INJURIES

Azarova, H. C. A report of two cases in which glass particles remained in the eye for long periods. *Viestnik Oft.*, 1943, v. 22, pt. 1, pp. 38-40.

During air raids the destruction of dwellings, and especially of windows, causes many ocular injuries with penetration of wood or glass splinters into the eyeball. Wood particles usually lead rapidly to suppuration. Metal particles are localized by X ray and are removed, the final outcome depending on the site and gravity of the injury, the type of metal, the skill of the surgeon, and the resistance of the patient. Glass is difficult to localize with the X ray, and it may remain in the eyeball for a long time without producing inflammatory phenomena: it is therefore often left alone in the eye if it appears to be tolerated. Nevertheless, the eye-

ball tends to free itself of the foreign body, which is sometimes extruded spontaneously after remaining in the eyeball for a long time.

Two cases are reported. A particle of glass lodged in the pars planum of the ciliary body in the left eye of a civilian, during a bombing raid. He developed a severe iridocyclitis, and was under treatment for ten weeks, during which time an unsuccessful attempt was made to extract the foreign body. After the operation the inflammation subsided, although for several months there were recurrent attacks of mild irritation, one of which was complicated by papillitis. The eye finally became quiet, and remained so for the year during which the case was under observation. There was a retinal detachment below and particles of glass could be seen in the vitreous. The second case was in a housewife whose right eye was injured during a bombing raid. She was found to have retinal detachment, and X-ray revealed a small intraocular foreign body and a large piece of glass in the antrum. The eye remained quiet, although blind, for 15 months, at the end of which time a particle of glass was spontaneously extruded from the original wound. Within the next three days the eyeball was lost from panophthalmitis, in spite of the vigorous use of sulfanilamides. Ray K. Daily.

Berens, C., Gara, P. F. de, and Loutfallah, M. Effect of sulfonamide ointment on healing of experimental wounds of rabbit cornea. *Arch. of Ophth.*, 1943, v. 30, Nov., pp. 631-644.

Because of the apparently growing importance of the sulfonamides in the treatment of civilian and military war wounds, it seemed desirable to study the effect of local treatment with an ointment containing 5-percent of sul-



fonamide compounds on the healing of experimental wounds of the cornea of rabbits. The wounds were produced (a) with sterile instruments (Graefe knives, wide keratomes, Hippel trephines) and (b) with similar instruments previously infected with hemolytic staphylococci.

Experimental wounds were produced on 88 corneas. Local use of the ointment referred to did not accelerate the healing of superficial or deep incised or trephined wounds of the cornea of rabbits if sterile instruments had been used to produce the injury. The ointment was of value in the treatment of wounds produced with instruments infected with *Staphylococcus aureus hemolyticus*. The results indicate therefore that local use of the sulfonamide compounds can be limited to cases in which chances of infection prevail. (References, two tables and twelve photomicrographs.)

R. W. Danielson.

Black, G. W. Results of treatment of traumatic cataract. *Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, pp. 215-222.

The author was able to make a follow-up examination on 40 patients out of 100 who during the previous ten years had had treatment for traumatic cataract. Of the 40 cases 34 showed perforating corneal injuries, and in 15 of these an intraocular foreign body was found. Divergent deviation was present in the majority of the patients, usually appearing a few months after the accident. It did not tend to occur when the cataract was partial and stationary.

In 22 cases the vision was no better than counting fingers, there being no possibility of improvement without further operation, and the poor vision

being due mainly to dense lens remnants and blocking of the pupil. Traumatic cataract with dislocation occurred twice in children, with loss of vision in one due to secondary glaucoma, and in the other associated with retinal separation. The author emphasizes that maximum mydriasis must be maintained after any injury to the lens or until healing and absorption have taken place. Beulah Cushman.

Davis, W. T. *Military ophthalmology*. *Amer. Jour. Ophth.*, 1944, v. 27, Jan., pp. 26-44. (References.)

D'Eramo, Cayetano. Traumatic myopia. *Anales Argentinos de Oft.*, 1942, v. 3, Oct.-Nov.-Dec., p. 207.

In a 25-year-old man a blow on the left eye with a fist resulted in a wound of the lower eyelid and reduced vision. The retinoscope showed 8 D. of myopia and vision was 6/6 with a -8 sphere. The myopia gradually diminished and at the end of 41 days the refraction was emmetropic and vision normal.

Eugene M. Blake.

English, P. B. Sap dermatitis and conjunctivitis caused by the wild fig (*Ficus Tumila*). *Med. Jour. Australia*, 1943, v. 1, June 26, p. 578.

Several cases are reported in soldiers. They were suffering from blistering of the skin of the forehead, the cubital fossae, and the genitals, as well as intense conjunctivitis and severe irritation of the nasopharynx. These men had been working in an area which contained two wild fig-trees. It is evident that the sap of the fig tree caused these lesions. Four cases of affliction of the eye are described in detail. Of these, two showed defect in the corneal epithelium. Only one was permanently impaired. In all the other

cases the lesions healed within a few days without permanent impairment of vision. Gertrude S. Hausmann.

Harkness, G. F. *Industrial ophthalmology*. Industrial Med., 1943, v. 12, Oct., pp. 658-662. (See Section 18, Hygiene, sociology, education, and history.)

Kaminskaya, Z. A. *Clinical symptoms and therapy of indirect ocular injuries*. Viestnik Oft., 1943, v. 22, pt. 2, p. 7.

This is a study of the pathology of the posterior ocular segment in ocular contusions, based on material seen in a base hospital. Ocular contusions were found most frequently in injuries of the lower outer orbital margin and the zygomatic arch. They occurred less frequently in injuries of the superior outer orbital margin, and were quite infrequent in injuries of the inner orbital wall and the nose. The history is fairly characteristic. Total loss or marked reduction of vision occurs immediately after the injury; frequently the patient sees a red fog. The symptoms may occur immediately, or they may be delayed for several days or months. Usually in cases of total loss of vision there was hemophthalmos, and in cases complaining of red vision there were vitreous hemorrhages. Hemorrhage into the vitreous associated with tears of the posterior hyaloid membrane is seen in the form of floating red bands. Reaching the anterior hyaloid membrane the blood becomes applied to its surface, or it permeates into the retrolental space, where it appears as a red band behind the lens. In some cases the vitreous becomes detached, and the hemorrhage is preretinal. In extensive detachments blood fills the folds in the hyaloid

membrane, and one sees reddish bands, swinging with movements of the eyeball, but not floating as do hemorrhages within the vitreous. In addition to vitreous hemorrhage, retinal hemorrhages of various intensity may occur. There appears to be no clear relation between the site of the retinal hemorrhage and that of the injury, although hemorrhages are observed more frequently on the side of the injury. Peripapillary hemorrhages are most frequent; they have a striated appearance, pointing to their location within the nerve layers of the retina. Second in frequency are macular hemorrhages. These may be continuous with the peripapillary hemorrhages, when they are also striated; or they may be limited to the macula and round in form, indicating localization in the peripheral retinal layers. Edema of the disc and retina may be encountered among the immediate symptoms. Choroidal ruptures in military injuries have an appearance entirely different from those seen in civil injuries. They may be found in any portion of the fundus and have the appearance of broken zig-zag intertwining lines. One gets the impression that the eyeball has suffered a severe insult as a result of which, so to speak, the choroid fell to pieces. Macular holes have occurred. The author saw several traumatic retinal detachments, but never a separation from the ora serrata. Optic neuritis was rare and recovered without leaving any sequelae. A few cases were without objective signs to account for the visual loss; most of these recovered vision although not always entirely. In these cases there was probably an edema of the external retinal layers, which when involving the macula caused immediately an intense impairment of vision. Partial permanent

visual loss is due to subsequent macular degeneration.

The late results of hemophthalmus are dense vitreous opacities, which reduce vision and may lead to retinal detachment. In several cases the author found synchysis scintillans. After absorption of the retinal hemorrhages, she found in several cases yellowish foci grouped in the periphery around the terminal vessels, and similar to those seen in the macula in hypertensive retinopathy. Usually edema of the retina subsided and vision was restored, although in one case there was a macular hole. Atrophic foci in the choroid are frequent. Hypotony, immediate or late, without iridocyclitis was seen in several cases.

The pathogenesis of these injuries Kaminskaya sees as a concussion within the eyeball, which in the anterior ocular segment causes subluxation of the lens, and in the posterior segment sets up a reverse wave which separates the vitreous from the membrana limitans interna. The vacuum left between the vitreous and the retina is conducive to hemorrhage, but the important factor is the change in the vessel wall itself. The primary spasm increases the permeability of the vessel wall, and the secondary dilatation facilitates the escape of blood into the tissues. The changes in the vascular wall are caused by the traumatic disturbance in ocular innervation. The hypotony usually present in a contusion of the eyeball indicates that an innervational disturbance in the secretory metabolism of the eyeball has taken place.

The immediate therapy should consist in inhalations of amyl nitrite to relieve the angiospasm. Later comes administration of calcium (1) by ionization, (2) internally, and (3) intra-

muscularly to diminish permeability of the vessel wall. Vitamin C serves the same purpose. To prevent subsequent development of retinitis proliferans, Zur Nedden's operation may be performed in extensive vitreous hemorrhages. For the absorption of vitreous opacities, iodine is given by ionization and internally. Blood transfusion was effective in one out of two cases. For the hypotony there is as yet no effective treatment. Ray K. Daily.

Kaminskii, D. C. Hole in the macula as a result of ocular contusion by firearms. *Viestnik Oft.*, 1942, v. 22, pt. 2, pp. 25-31.

Seven cases observed in an evacuation hospital are reported. Six were injured with a fragment of a mine, and one with a bullet. In six cases the ocular trauma was indirect, being associated with contusions and damage to the outer orbital wall. One case showed direct injury to the eyeball. In two cases the pathology developed six weeks after the injury and was limited to the macula, with the exception of chorioretinal foci at the periphery, which probably resulted from hemorrhages. The author believes that the pathology in the retina caused by contusion is similar to the process taking place in the brain; an edema of colloids, as a result of cellular shifts, and a disturbance in metabolism due to innervational disturbances in the vessel walls. Depending on its intensity, the edema may subside with functional recovery, or the macula may degenerate leaving a hole.

In three cases, immediately after the contusion there were vitreous opacities and retinal hemorrhages. After absorption of these the defect in the macula became apparent. The retinal hemorrhages, and also probably hemorrhages

into the suprachoroidal space, aggravated the destructive process in the injured macula. In one case of direct contusion the fragment entered the right orbit temporally and lodged in the superior orbital fissure. The foreign body thus traversed the entire depth of the orbit, passing between the outer orbital wall and the eyeball. No choroidal or retinal tear could be found, but the contusion led to pathologic changes in the macular colloids with subsequent macular degeneration. These six cases, differing in the type of injury and the extent of damage, have the same final visual result, a central scotoma. For therapy the author suggests antiedematous agents, locally and intravenously. (7 illustrations.) Ray K. Daily.

Karandasheva, K. M. A case of ocular contusion by a bullet. *Viestnik Oft.*, 1943, v. 22, pt. 2, pp. 48-50.

Entering at the outer side of the eyeball a bullet lodged in the posterior portion of the orbit. There was exophthalmos, with limitation of motion, choroidal and vitreous hemorrhages, and central retinal edema. Vision was 1/1000. The bullet was extracted a week after the injury, and at discharge the patient's vision was 2/100. The unusual feature of this case is the entrance of the bullet into the orbit without splintering the bone or shattering the eyeball. (3 illustrations.)

Ray K. Daily.

Kaznelson, A. B. Gunshot lesions of the orbit. *Viestnik Oft.*, 1943, v. 22, pt. 2, pp. 13-23.

In the present war, injuries caused by mine splinters are more numerous than bullet wounds. Of orbital wounds in an evacuation hospital, 23 percent were produced by bullets and 77 percent by mine fragments. The wide use

of mines and grenades results in numerous cases of multiple wounds of the face and eyes caused by flying splinters. The type and character of the damage depend on the caliber and size of the bullet, the shape of the splinters, their velocity, and the distance they travel. Because of the low resistance of the thin bony walls of the upper jaw, a shot from a distance of 800 to 1000 meters produces a through-and-through ragged wound. From a distance of 300 to 500 meters it causes numerous fractures with heavy destruction of the soft tissues at its exit. Striking from within a distance of 200 meters it produces a splintering injury. Because of ragged edges and rotating movements, splinter damage is more severe and extensive than that produced by bullets. Orbital injuries are rarely isolated and are usually a part of extensive damage to the face and skull. In 50 percent of the cases the paranasal sinuses were damaged, and in 24 percent the brain was involved. The appearance and size of the point of entry is not always indicative of the depth and extent of the damage. In 25 percent of the cases the fragments were found on the side opposite their entry, and in some cases the point of entry was at a distance from the orbit. There were cases in which the fragment entered through the lower lid of one eye, passed through the nose, and was arrested in the orbit of the opposite side. As a result, in the apparently severely damaged orbit the eyeball had symptoms of contusion, and in the good orbit the eyeball was perforated. Very frequently there is a disparity between the points of entry and the number of fragments shown by X ray, because the original fragment splinters on striking the bone and its fragments scatter in various directions. For this reason all orbital injuries

should be subjected to thorough clinical and roentgenologic study. The peculiarities of military injuries force the ophthalmologist to go beyond the orbital walls in order not to overlook injuries to the skull.

The clinical picture of these injuries varies greatly. The author proposes a classification based on the direction and extent of the wound and the relation of the foreign body to the orbit. The first division is into direct and indirect injuries. The direct are divided into diagonal, perpendicular, and contusion injuries. The diagonal and perpendicular are subdivided into those in which the bullet or fragment passes through the orbit, and those in which the destructive agent is arrested in the orbit. The clinical pictures for each of these types are described in detail.

The abundant blood supply of the face favors rapid healing of wounds, and accounts for the rarity of severe infections. Quite contrary to the rules for dealing with wounds in other parts of the body, all conjunctiva and lid tissue should be conserved, even if it appears hopelessly destroyed. One should leave in the wound all fragments of bone if they are attached to the soft tissue: osteomyelitis of the orbital bones in gunshot injuries is very rare, and fragments of bone serve to stimulate the reconstruction of fractured bones. The danger of gas infection on the face is negligible, and primary sutures should be introduced in order to prevent deformity of the lids, requiring subsequent plastic procedures. Particular attention should be paid to restoration of the conjunctival sac, because torn conjunctiva tends to adhere to bony fragments and to retract into the cicatrix. Wounds sutured even 8 to 12 days after the injury have healed well. Removal of accessible foreign

bodies should be attempted if they cause inflammatory phenomena, or, if they are located within the nasal sinuses. The military ophthalmologist should be conversant with injuries about the orbit and should know when to call in a surgeon or a neurosurgeon. Streptocide, a soluble sulfa drug, is used freely in the wounds. In exophthalmos due to retrobulbar hemorrhage it is well to suture the lids in order to safeguard the cornea. There is no indication for hasty enucleation of a destroyed eyeball. In cases in which a purulent discharge persists for a long time after enucleation one should suspect a fistula connecting the orbit with a nasal sinus which contains a foreign body. Roentgenographic investigation and elimination of the offending agent will usually be followed by cessation of the discharge. Ray K. Daily.

Liorber, G. C. **Retinal injuries.** *Viestnik Oft.*, 1943, v. 22, pt. 2, pp. 31-33.

A review of the literature on the etiology of retinal detachment, with special emphasis on macular holes, and including eight cases of holes in the macula reported in the Russian literature from 1910 to 1936. The author's own case was in a student, 14 years old, whose left eye was injured in an explosion of matches which he was grinding in a mortar. In addition to a contusion of the lids and a subconjunctival hemorrhage, he had a hole in the macula, which left him with a permanent central scotoma, and 0.2 visual acuity. Ray K. Daily.

Lippincott, S. W., and Blum, H. F. **Neoplasms and other lesions of the eye induced by ultraviolet radiation in strain-A mice.** *Jour. Nat. Cancer Inst.*, 1943, v. 3, June, p. 545.

Neoplasms and other lesions of the

eye induced by ultraviolet radiation are described. Pathologic changes are superficial, being confined primarily to the cornea. There may be inflammatory changes, and the iris and lens may be involved secondarily. The tumors observed have been sarcomas and hemangioendotheliomas of the substantia propria. Changes in the epithelium of the cornea suggest that carcinomas may occur at times. The possible etiologic rôle of sunlight in producing lesions of the human eye is discussed. (6 illustrations.)

Gertrude S. Hausmann.

McLane, J. N. Retinal hemorrhage in a case of rattlesnake bite. *Jour. Florida Med. Assoc.*, 1943, v. 30, July, p. 22.

A patient complained that, following the bite of a rattlesnake, the vision had been impaired in his eye. Examination of the fundus revealed a large round-shaped hemorrhage close to the macula area. Retinal hemorrhages are rarely recorded in patients bitten by poisonous snakes, chiefly because cases of very serious poisoning with involvement of the nerve center are seldom examined ophthalmoscopically before death.

Gertrude S. Hausmann.

McNabb, H. H. The treatment of traumatic cataract. *Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, pp. 207-213.

The author advises expectant treatment of traumatic cataract. In adult patients with a hard nucleus the progress must be watched very carefully, as many individuals are sensitive to the action of their own lens protein, and iritis, cyclitis, or endophthalmitis may develop. Wounds associated with penetrating injuries by splinters of wood, forks, and the like almost invariably become septic, and for them the use of

the sulfa drugs locally has been of great help.

Beulah Cushman.

Mann, I., and Pullinger, B. D. A study of mustard-gas lesions of the eyes of rabbits and men. *Amer. Jour. Ophth.*, 1943, v. 26, Dec., pp. 1253-1277. (25 illustrations, 2 tables.)

Markelova, Z. H. Nonperforating wounds of the eyeball and lids. *Viestnik Oft.*, 1943, v. 22, pt. 1, p. 27.

Of the ocular military injuries, 58 percent were nonperforating. Accurate diagnosis and prompt treatment in the field hospital permitted 38 percent of these to return to service; 62 percent were sent to a base hospital. The lids and cornea were injured most frequently; rarely the sclera and conjunctiva. Most severe are the corneal injuries, which if not cared for properly are rapidly complicated by iritis and synechia, with visual impairment. Early atropinization of such cases is important. All corneal injuries should be hospitalized until complete recovery. Premature discharge has frequently led to an aggravation of the inflammatory process. The sharp injuries and blows as a rule injured the lids; blunt injuries affected the cornea. Foreign bodies embedded in the lids without causing inflammatory reactions were not removed. Of 57 lid injuries only 14 required repair with sutures. The right eye was injured in 52.5 percent of cases, the left in 42.5 percent, and both in 5 percent.

Ray K. Daily.

Martin, W. O. Treatment and care of common eye injuries. *Jour. Med. Assoc. Georgia*, 1943, v. 32, June, p. 189.

The author believes that every physician should be able to render first aid for the most common types of eye in-

jury. He reviews briefly the anatomy of the eyeball and the treatment of common corneal involvements, including burns. He condemns the promiscuous use of atropine.

T. M. Shapira.

Michaelson, I. C., and Kraus, J. War injuries of the eye. *Brit. Jour. Ophth.*, 1943, v. 27, Oct., pp. 449-461.

Seven cases of double injury to the walls of the eyeball by foreign bodies are described. In six cases in which the fundus could be observed ophthalmoscopically, a solid, raised white mass was seen projecting into the vitreous at the site of the exit wound. Two of the cases which were examined histologically showed proliferated choroid tissue projecting into the vitreous through a gap in the overlying retina. The plugging of the retinal gap by the choroid reaction would appear to be purposive in nature, because only two cases showed detachment of the retina, in spite of large retinal holes. (14 illustrations.)

Edna M. Reynolds.

Mitskevich, L. D. Technique of suturing wounds of the lids. *Viestnik Oft.*, 1943, v. 22, pt. 2, pp. 46-47.

The author describes a figure-eight suture for repair of through-and-through wounds of the lids. This suture, which brings together the cartilage and conjunctiva, makes for better coaptation of the wound edges, and prevents overriding of the cartilage segments. In first aid to lid injuries careful débridement with immediate suturing is important. For good healing it is important to have no tension on the sutures, and this the author accomplishes by means of canthotomy. (2 illustrations.)

Ray K. Daily.

Pfeiffer, R. L. Traumatic enophthalmos. *Arch. of Ophth.*, 1943, v. 30,

Dec., pp. 718-726; also *Trans. Amer. Ophth. Soc.*, 1943, v. 41.

Of 120 cases of fracture of the bones of the face in which the orbit was involved, enophthalmos was present in 53. Fracture of the orbit was observed in every case of traumatic enophthalmos during a period of ten years. All of the cases of traumatic enophthalmos uniformly showed roentgenographic evidence of a fracture of the floor of the orbit, with prolapse of orbital tissue into the maxillary sinus. In cases of severe enophthalmos the entire antrum was filled with orbital tissue.

The convex posterior portion of the floor of the orbit bulges upward back of the eyeball in a position to receive most of the force transmitted by a blow on the eye. As the floor is composed of very thin bone, it is easily ruptured, allowing orbital contents to herniate. Following such a displacement there is enophthalmos, often with disturbances in motility of the eye. Paresthesias of the face from fracture of the infra-orbital canal and rupture of the infra-orbital nerve are common.

Treatment may not be indicated unless the displacement is severe. Muscle operations have successfully overcome diplopia. The surgical correction of the enophthalmos is under study. Some attempt should be made to replace the inferior orbital wall and to prevent the herniation of orbital contents. The author suggests that patients exhibiting signs of recent contusion to the orbit be subjected to roentgenographic examination for possible internal fracture of the orbit. (2 photographs, 3 roentgenograms, 2 tables, bibliography.)

John C. Long.

Philps, A. S. The extraction of magnetic foreign bodies from the vitreous chamber of the eye. *Trans. Ophth. Soc.*



United Kingdom, 1942, v. 62, pp. 169-176.

The author describes the use of the magnet in removing foreign bodies from the vitreous through an opening made in the sclera.

The foreign body is localized with the use of the ophthalmoscope and X-ray, and if possible is drawn by a magnet into the area of the external rectus. The conjunctiva is opened and the external rectus muscle divided. A linear incision is made in the sclera after sutures have been placed, and the magnet is applied and the foreign body removed. The scleral suture is tied, the rectus muscle repaired, and the conjunctiva closed. Fifteen percent of the patients so treated showed vision of 6/12 or better; 11 percent, 6/18 to 6/60; 23 percent, finger counting and good perception; 50 percent, no light perception but the eye of normal size; 4 percent had shrunken eyes, and 42 percent of the eyes were lost. (4 illustrations.)

Beulah Cushman.

Pokrovsky, A. J. Characteristics of intraocular foreign bodies in military and civil injuries, and the technique of their removal. *Viestnik Oft.*, 1943, v. 22, pt. 1, p. 4.

This is a comparative study of 125 war injuries and 125 industrial injuries. The foreign bodies of war and industrial injuries differ in their magnetic properties. In industrial injuries 85 percent of the foreign bodies are magnetic. In war injuries 30 to 40 percent are nonmagnetic. An important characteristic of the foreign bodies in war injuries is their multiplicity and minute size. Not one of the industrial cases showed more than one foreign body; in the war injuries 15 percent of the eyes had several foreign bodies. In war injuries the foreign bodies penetrate

deeper into the posterior ocular segment, and may pass through the eyeball; double ocular perforations are therefore much more frequent in war injuries.

The operative data differed widely in the two types of injuries. In civil injuries, 70 to 75 percent of the foreign bodies were extracted within the first week after the injury. Because of the necessity of passing through several hospital stations the majority of war injuries were operated upon 20 to 70 days after injury. Of the industrial foreign bodies 82 percent were successfully removed with the electromagnet. Early in the war electromagnetic extractions were successful in 64 percent of war injuries. With accurate roentgenographic localization this percentage was increased to 72.

The author is an advocate of extraction through the sclera; he holds that extraction by this route is more often successful, and is followed by more rapid recovery and by less marked inflammatory reaction. The foreign body is less apt to be caught in the ciliary processes or iris, or to set up a cyclitis. The author uses prophylactic diathermy-coagulation of the sclera, which prevents retinal detachment and intraocular hemorrhage.

The delay in extraction of foreign bodies in war injuries adds to the difficulty of the procedure. After they become fixed in an exudate, they offer greater resistance to the electromagnet. To attract them with the greatest possible electromagnetic force they should be very precisely localized. This is possible only through close coöperation of ophthalmologist and roentgenologist.

Ray K. Daily.

Reese, A. B., and Khorazo, D. Endophthalmitis due to *B. subtilis* follow-

ing injury. *Amer. Jour. Ophth.*, 1943, v. 26, Dec., pp. 1251-1253. (References.)

Sudakevich, D. I. Orbital prosthesis for the sequelae of war injuries. *Viestnik Oft.*, 1943, v. 23, pt. 1, p. 25.

Protheses intended to replace losses of the facial tissues should be thin, small, and light, and should fit firmly to the face without interfering with movement of the facial muscles. This paper is an attempt to classify orbitofacial injuries for the purpose of determining the type of material suitable for a prosthesis. The author divides the injuries into orbital, orbitofrontal, orbitonasal, and orbitomalar. In orbital injuries the orbicularis oculi may be partially or totally destroyed. In partial destruction the muscle is contracted and will press on the edges of the prosthesis. In total destruction a soft prosthesis will have no support. Therefore prosthesis for orbital defects should be made of firm inelastic material. In orbitomalar injuries the prosthesis should be of soft pliable material, because cicatrices of the muscles of the face will tend to displace it forward and upward.

The orbitofrontal and orbitonasal injuries occupy an intermediate position between the orbital and orbitomalar. In orbitonasal injuries, contraction of the corrugator pulls the inner edge of the eyebrow down and in; the prosthesis should be firm, inelastic, and fastened to the bridge of the nose; and cases with destruction of the ala of the nose require elastic prosthesis.

Orbitofrontal injuries raise the eyebrows and upper lids, with frequent total destruction of the eyebrows. Destruction of the eyebrows and prominence of the upper margin of the orbit are indications for inelastic material to which can be fastened artificial eye-

brows. Extensive destruction of the forehead should be replaced by a pliable prosthesis. Ray K. Daily.

Treatment of eyes injured by mustard gas. *Brit. Med. Jour.*, 1943, July 24, p. 111.

The clinical picture of the eye injured by mustard gas has three stages: first, stage of impregnation; second, acute stage; third, stage of recovery. The onset is without any symptoms and the gas becomes impregnated in the eye without any pain or discomfort. This lasts one to three hours. The acute stage begins suddenly with hypersecretion of the conjunctival and lacrimal glands. Edema of the eyelids closes the palpebral fissure. This lasts from two to five days. In recovery, the edema of the lids slightly subsides but the lacrimal secretion and the photophobia persist. This may last for weeks or months.

Bonnefon, in the First World War, irrigated the eyes with a warm hypertonic solution containing sodium sulphate. Even in cases of very intense palpebral edema this solution enters the fissure and osmotic drainage can occur. The osmotic treatment should be continued as long as there is any photophobia and lacrimation. Cocaine must never be used, as it will cause damage to the corneal epithelium. Liquid paraffin and oily drops must not be used so long as there is any possibility of dichlorethyl sulphide remaining in the conjunctival sac, because they are solvents of this substance and may cause further damage.

Gertrude S. Hausmann.

Turner, J. W. A. Indirect injuries of the optic nerve. *Brain*, 1943, v. 66, June, pp. 140-151. (See Section 11, Optic nerve and toxic amblyopias.)

## 17

## SYSTEMIC DISEASES AND PARASITES

Allen, M., Flack, F., and Billings, M. L. Three pedigrees of eye defects. (Nystagmus and myopia.) *Jour. of Heredity*, 1942, v. 33, Dec., p. 453.

Two of the three short histories deal with hereditary nystagmus. The first includes case records of four school children.

The article "A familial study in myopia" discusses the presence and progress of shortsightedness in several families. Since all the patients included in the author's chart showed myopia before they were ten years old, he thinks it unlikely that use is a factor in the causation of this condition.

F. M. Crage.

Bellows, J., Cooper, J., and Bull, H. B. Electrophoretic studies on serums of patients with ocular disturbances. *Arch. of Ophth.*, 1943, v. 30, Nov., pp. 621-625.

The electrophoretic technique of Tiselius has been used by a number of workers to study the proteins in normal and pathologic human serums. In short, the components of a mixture of proteins are separated by their difference in mobility and the number and concentrations of the components determined.

Studies of serum proteins by earlier methods in cases of glaucoma failed to disclose abnormalities. In this paper the data obtained in electrophoretic analyses of the serums of 18 patients with various pathologic conditions are presented. The authors point out that for the most part the patients used in this study had other pathologic conditions associated with the ocular lesions.

The appearance of new protein fractions seemed to be a characteristic

observation in cases of chronic intraocular disease. This is thought to suggest that the pigment is the more important factor. Slight indications of the new fraction were found in the serum of patients with secondary glaucoma following extracapsular extraction and cortical cataract. (References, 1 table and 1 series of diagrams.)

R. W. Danielson.

García Miranda, Antonio. Importance of the slitlamp in the study of starvation conditions. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1942, v. 1, July, pp. 108-113.

This is stated to be a preliminary communication. In the many cases of starvation or undernourishment following the Spanish civil war, the author noted a conjunctival injection which under high magnification was found to be arranged in two plexuses, one superficial and the other deep. This conjunctival injection is taken to be the first ocular manifestation of avitaminosis-A, perhaps present earlier than hemeralopia. When the process is further advanced, the injection is less noticeable, because the conjunctiva is thickened and the conjunctival vessels are obscured by conjunctival opacities. The Bitot spots appear still later. These early signs are seen more particularly in the conjunctival area corresponding to the palpebral fissure, and above all toward the caruncle and semilunar fold as well as in the region of the sclerocorneal limbus. Administration of riboflavin produced retrogression of the vascularity. The author suggests that the resemblance between the condition he describes and some forms of pannus or of keratitis from acne rosacea requires further investigation. (2 illustrations, references.) W. H. Crisp.

Green, Raymond. The role of vitamins in ophthalmology. *Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, pp. 47-51.

From the general knowledge of vitamins and the author's own experience in polar expeditions he gives a table of the nature and source of the vitamins, the daily need, and signs of deficiency. He emphasizes that deficiency diseases seldom occur singly, and that deficiency may arise from deficient intake, deficient absorption, or increased needs of the body. A symptomless deficiency may carry on until some special condition arises, such as an injury or operation. Or the deficiency may be shown by undue susceptibility of the mucous membranes to infection. Fatigue is the symptom always found in frank deficiency. Beulah Cushman.

Harms, H. Interrelationships between the condition of the nervous system and the eye. *Med. Klin.*, 1942, v. 38, Aug. 7, pp. 745-749.

This somewhat diffusely written article touches upon many points of relationship between the eye and the general nervous system, including scotoma scintillans, unilateral amblyopia, retrobulbar neuritis, cerebral concussion, disturbances of the fusion apparatus, hysterical blindness and ophthalmoplegias, and glaucoma.

W. H. Crisp.

Parry, T. G. W., and Laszlo, G. C. Herpes zoster ophthalmicus—two rare manifestations. *Brit. Jour. Ophth.*, 1943, v. 27, Oct., pp. 465-467.

A case of acute retrobulbar neuritis and one of right abducens nerve paresis, both following herpes zoster ophthalmicus, are reported.

Edna M. Reynolds.

Pett, L. B. Riboflavin and vitamin A in relation to "eyestrain." *Canadian Med. Assoc. Jour.*, 1943, v. 49, Oct., pp. 293-295. (See Section 3, Physiologic optics, refraction, and color vision.)

Scobee, R. G. Ocular findings in feeble-minded male castrates. *Amer. Jour. Ophth.*, 1943, v. 26, Dec., pp. 1289-1298. (One table, references.)

Shapiro, A. L. Blindness and multiple neuritis from vitamin-B deficiency. *Med. Bull. Veterans' Admin.*, 1943, v. 20, July, p. 106.

A case of multiple neuritis and blindness due to alcoholism is reported, and the relation of the disorder to vitamin-B deficiency is discussed. The patient was receiving a regular hospital diet, apparently adequate as to vitamin B, yet no improvement was obtained until large concentrated doses of thiamine were given, intramuscularly. Despite the long period of time which had elapsed before improvement was obtained, the author remarks that complete recovery proved possible once adequate therapy was instituted. Alcoholic addicts are especially susceptible to vitamin-B deficiency.

Gertrude S. Hausmann.

Williamson Noble, F. A. The role of vitamins in ophthalmology. *Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, pp. 53-63.

A review of the literature is given. Vitamins in their crude form, such as vitamin A in cod-liver oil, are of more clinical value. Vitamins B and C are important in the metabolism of the cornea, the most important being riboflavin. Riboflavin cannot be synthesized by the cells of the body, and a continual supply from exogenous sources is re-

quired to make up what is lost in the urine and other excretions. Probably the metabolism of the avascular cornea is maintained by riboflavin. Corneal grafts are kept healthy by the cornea's own oxidative system independent of the blood supply. If this fails, the demand for hemoglobin results in corneal vascularization.

The lens seems dependent on the lactoflavin fraction of vitamin B. It does not, like the cornea, become vascularized if the enzymes are deficient, and it therefore degenerates. Vitamin C may provide the alternative means of respiration for the lens.

The deficiency of vitamins C, K, and P can be studied particularly well in the retina, as such deficiencies produce hemorrhages by various mechanisms. In vitamin-C deficiency, capillary hemorrhages are characteristic, arising from failure of the cement substance between the endothelial cells, and there is also a decrease in the coagulation time. Vitamin K, fat-soluble, is thought to combine with an unknown hepatic product to form prothrombin. Vitamin P probably has its action on the cell bodies of the capillaries, and increases their resistance to pressure. (Bibliography.)

Beulah Cushman.

## 18

### HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Andrade, Cesario de. The Portuguese language in American congresses of ophthalmology. *Arquivos Brasileiros de Oft.*, 1943, v. 6, June, pp. 98-100.

The author is pleased to record recognition of the Portuguese as well as the Spanish language as official during the Pan-American Congress of Ophthalmology in Cleveland, 1941. A "Brazil-United States Institute" has been

established at Rio de Janeiro. The author further mentions as significant of the general international movement the fact that a great many courses for the teaching of Portuguese have been organized in the United States.

W. H. Crisp.

Chance, Burton. Emile Javal. *Amer. Jour. Ophth.*, 1944, v. 27, Jan., pp. 45-48.

Chance, Burton. Ophthalmology in Philadelphia in the early eighteen nineties. *Trans. and Studies, Coll. Phys. of Philadelphia*, 1943, v. 11, June, pp. 77-81. (See *Amer. Jour. Ophth.*, 1943, v. 26, Nov., p. 1164.)

Elder, J. H. Effectiveness of vitamin A in the treatment of defective color vision. *Science*, 1943, v. 97, June 18, p. 561. (See Section 3, Physiologic optics, refraction, and color vision.)

Fox, S. A. Optometry: a medical viewpoint. *Dis. Eye, Ear, Nose, and Throat*, 1942, v. 2, Dec., p. 369.

The controversy between optometrists and ophthalmologists is discussed at length. Eventually optometry may "have to decide whether it is to be a skilled trade which purveys glasses or a profession devoted to eye treatment." One ophthalmologist feels that if optometry continues in its present course "the medical schools may find it necessary to absorb the teaching and control the practice of this profession." The increase in postgraduate medical study and consequent increase in eye physicians will force a decision. Closer relationship between the general practitioner and patient, which will cause the physician to refer the needy to the ophthalmologist, should help solve the problem of proper attention for eye troubles.

F. M. Crage.

Halliday, J. C. The causes of blindness in children. *Med. Jour. Australia*, 1943, v. 1, June 19, p. 556.

The cases admitted to the school for deaf and blind during the years 1911 to 1920 are tabulated. Optic atrophy, congenital cataract, and ophthalmia neonatorum seem to be the leading causes. Another summary several years later showed fewer cases of ophthalmia neonatorum. (2 tables.)

Gertrude S. Hausmann.

Harkness, G. F. Industrial ophthalmology. *Industrial Med.*, 1943, v. 12, Oct., pp. 658-662.

The author, in surveying lightly the fields of industrial ophthalmology and otolaryngology, stresses the fact of governmental responsibility in the conservation of public health, and the consequent need for adequate unification of state laws regarding compensation and conservation of vision. It is important for the ophthalmologist, in turn, to have a proper basis for evaluating visual efficiency, and to be familiar with the specific needs of those industries with which he is connected. The surgeon is an important figure in the safety program of each industry. In this connection, the ophthalmologist should be familiar with proper lighting conditions. Any uncertainty regarding the compensability of an eye condition should be resolved in favor of the employee. The surgeon likewise has a responsibility to his employer, and must constantly be on the alert for malingerers.

In considering corneal foreign bodies and minor eye injuries, the author emphasizes the desirability of X-ray examination in every case at all suspicious. The technique for removal of foreign bodies is described; the author

feels that an eye patch is not indicated in every case, and that the guiding factor should be the subjective symptoms. Conservation of man-hours of work is a most important consideration.

(The paper contains also a number of observations on otolaryngological problems.) Benjamin Milder.

Judd, D. B. Color-blindness and the detection of camouflage. *Science*, 1943, v. 97, June 18, p. 544. (See Section 3, Physiologic optics, refraction, and color vision.)

Kravkov, C. V. The significance of Newton's work in physiologic optics. *Viestnik Oft.*, 1943, v. 22, pt. 1, p. 3.

Kravkov credits Newton with being the founder of the physiology of color vision. In Newton's books on optics are found accurate descriptions of the refractive errors and of afterimages, and a correct conception of the crossing of the optic nerves at the chiasm. The relation of color perception to the physical properties of light was discovered first by Newton, who demonstrated that color differentiation was due to the varying refraction of the respective colored rays of light. On the principle of finding the center of gravity in mechanics, he designed a color circle with a method for determining the color resulting from various color mixtures.

Ray K. Daily.

Schurr, C. G. Rehabilitation of the uniocular patient. *Brit. Jour. Ophth.*, 1943, v. 27, Oct., pp. 467-469.

The training program of the Royal Sussex County Hospital Rehabilitation Department for uniocular patients is outlined. The advantages of early training, beginning within a day or two after removal of the eye, are stressed.

Edna M. Reynolds.

Vishnevsky, H. A., and Flekkel, A. B. A study on the recognition of colored signals by persons with defective color vision. *Viestnik Oft.*, 1943, v. 23, pt. 1, p. 16. (See Section 3, Physiologic optics, refraction, and color vision.)

Wetzel, J. O. Blindness in Michigan. *Jour. Mich. State Med. Soc.*, 1943, v. 42, Jan., p. 39.

The author presents a survey with many statistical data. He also discusses blindness in the United States and Great Britain. His series includes over two thousand cases of adult blindness. In only 927 cases was the etiology undetermined or unspecified.

T. M. Shapira.

## 19

### ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Clark, W. E. L. The anatomy of cortical vision. (Doyle Memorial Lecture.) *Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, pp. 229-245.

As an anatomist the author is interested in the significance of the six-layer pattern of the lateral geniculate body. He obtained the brain of a monkey who had lost an eye in an accident some years before death. Later he was able to study the brain of a woman whose eye had been removed for glaucoma two years before death. In both instances the geniculate bodies showed exactly the same pattern of three layers receiving crossed fibers and the other three receiving uncrossed fibers. From these findings the writer became interested in following the projection of local retinal lesions on to corresponding local areas of cell atrophy in the nucleus, and he and his colleague Penman were able to determine the pattern of localization in the geniculate

body with great accuracy and to show that it represented point-to-point projection.

Transneuronal degeneration, which could be detected in the geniculate body one week after section of the optic nerve, might be indicative of an extreme specificity of function of the cells of the nucleus, and suggested to the author that the cells might depend entirely for continued activity on the reception of impulses from the retina, and that there were no other sources of afferent stimuli which maintained their vitality.

It was found that the optic nerves ended in the geniculate body in specialized ring formations, "terminal buttons." Degenerative reactions were demonstrable seven days after section, and direct proof was obtained that crossed fibers end entirely in laminae 1, 4, and 6, and uncrossed fibers entirely in laminae 2, 3, and 5. Each optic-nerve fiber ended in its appropriate lamina by dividing into 5 or 6 terminal branches, and each of these branches established connection with only one cell. It was also found that if the visual cortex of a monkey was completely destroyed all the nerve cells of the corresponding geniculate body appeared to undergo complete atrophy.

The three laminae for each eye also called for explanation, the lamination of the lateral geniculate bodies appearing abruptly during the sixth fetal month. One optic nerve of a monkey was sectioned. After time for degeneration of the optic fibers, sections of the optic tract showed no evidence of laminar arrangement, and it was only within the geniculate body that the retinal fibers sorted themselves out to reach their appropriate laminae. The author noted at this time that the smallest retinal lesion produced recog-



nizable changes affecting portions of all three of the corresponding cell laminae. He came to the conclusion that the conducting unit from the retina to the lateral geniculate body was a three-fiber unit. This supports the idea that the laminar pattern of the geniculate body may be related to trichromatic color vision. By means of the geniculate body, crossed and uncrossed retinal impulses are supposed to be brought into intimate relation with each other immediately on their

arrival at the cortex, thus providing for fusion of impressions necessary in stereoscopic vision.

Finally the author concludes that the geniculate body is a simple relay mechanism through which retinal impulses are immediately projected on to the visual cortex, and that there is no possibility that these impulses can be distorted and modified by other unrelated types of nervous impulse influencing the cells of the nucleus. (4 illustrations, references.) Beulah Cushman.

# NEWS ITEMS

Edited by DR. DONALD J. LYLE  
904 Carew Tower, Cincinnati 2

News items should reach the editor by the twelfth of the month

## DEATHS

Dr. Athens V. Lodge, Brewster, Massachusetts, died November 18, 1943, aged 71 years.

Dr. Thomas O. Brown, Osage, Kansas, died November 12, 1943, aged 74 years.

Dr. H. Harms, Newton, Kansas, died November 25, 1943, aged 84 years.

Dr. Adolph F. Hofkin, Philadelphia, Pennsylvania, died December 12, 1943, aged 68 years.

Dr. Harry W. Houf, Sr., Minturn, Colorado, died December 3, 1943, aged 68 years.

Dr. Edward A. Kennedy, Pittsfield, Massachusetts, died December 14, 1943, aged 63 years.

Dr. Alfred L. Marks, Spokane, Washington, died in December, 1943, aged 63 years.

Dr. Charles E. Padelford, Holley, New York, died December 6, 1943, aged 74 years.

Dr. James A. Bach, Milwaukee, Wisconsin, died November 29, 1943, aged 83 years.

Dr. Roger Biswell, Baker, Oregon, died November 12, 1943, aged 62 years.

Dr. Arthur E. Gadbois, Norfolk, Nebraska, died November 19, 1943, aged 68 years.

Dr. Carlton D. Morris, Pontiac, Michigan, died November 28, 1943, aged 73 years.

Dr. Louis S. Smith, Brooklyn, New York, died October 23, 1943, aged 47 years.

Dr. Charles H. May, New York, New York, died December 7, 1943, aged 82 years.

Dr. Raymond D. Sleight, Battle Creek, Michigan, died December 7, 1943, aged 68 years.

Dr. Edmond E. Blaauw, Buffalo, New York, died December 4, 1943, aged 76 years.

Dr. Charles H. Brobst, Peoria, Illinois, died November 25, 1943, aged 77 years.

Dr. Henry W. Champlin, Towanda, Pennsylvania, died December 8, 1943, aged 86 years.

Dr. Sanford Robinson Gifford, Chicago, Illinois, died February 25, 1944, aged 52 years.

Dr. A. Vogt, Zurich, Switzerland, died December 10, 1943, "after a severe disease."

## MISCELLANEOUS

The Department of Ophthalmology of the George Washington University School of Medicine will give its seventh annual postgraduate course in ocular surgery, pathology, and orthoptics, April 24 to 29, 1944, inclusive. This is a practical course, limited to 30 registrants. Surgery will be performed by the registrants on animal eyes. Ocular pathology will be illustrated with slides and by the use of the microscope. Orthoptic training will be taught

with cases and demonstrations. The fee is \$150.00. Further details will be furnished by the secretary, Miss Louisa Wells, 927 Seventeenth Street, N.W., Washington, D.C.

The Department of Otolaryngology of the University of Illinois College of Medicine announces its spring refresher course, to be held at the College in Chicago, March 20th to 25th, inclusive. The course is intended primarily for specialists who, under existing conditions, are able to devote only a brief period to postgraduate review study. The fee is \$50.00. Registration will be limited. In requesting application, state school and year of graduation; and give details concerning specialty training and experience. Address: Department of Otolaryngology, University of Illinois College of Medicine, 1853 West Polk Street, Chicago, Illinois.

One of our advertisers, the National Electric Instrument Company, was the recipient in November, 1943, of a star for its Army and Navy "E" award. National received its Army and Navy "E" award in February, 1943.

A gift of \$10,000 was given to the Department of Ophthalmology of the Medical School of the University of Kansas by Dr. Edward J. Curran of Kansas City, professor and head of the department of ophthalmology, to provide the necessary equipment and assistance for research in the department.

## SOCIETIES

The third regular meeting of the Ophthalmological Society, European Theater of Operations, was held on November 13, 1943, in the sumptuous new Officers Club Auditorium at the Headquarters of the 8th Air Force. There was an attendance of nearly 100, including many flight surgeons and guests from Allied Services.

The group was welcomed by Brig. Gen. Malcom C. Grow (MC), Surgeon, U.S.A. Air Forces in this theater, and host, Brig. Gen. Paul R. Hawley (MC), Chief Surgeon, E.T.O., spoke briefly, commending the ophthalmic medical officers for being the first and most active group in this theater in organizing their specialty, and in publishing a journal. Four excellent moving pictures of ocular surgery were shown. Dr. S. A. Leader, one of Britain's leading authorities in the manifold application of new plastics in the field of medicine, gave a most instructive talk on this sub-

ject. In ophthalmology plastics are already invaluable in the production of prostheses and contact lenses, and will play an increasing role in the protection of the globe in severe burns, and in the construction of large prosthetic appliances for deformities of the face. Plastics can meet any requirement in consistency, color, form and radio-opacity, and can be made self-sterilizing. The morning program closed with an interesting discussion on "Macular degeneration of unknown origin" by Squadron Leader J. Doggart, R.A.F., and a consideration of "Ophthalmic surgery in the field" by Brigadier Sir Stewart Duke-Elder, Chief Ophthalmic Consultant, R.A.M.C. Sir Stewart described the problems, experiences, and lessons encountered by ophthalmic medical officers with British Forces in Africa and the Middle East. He emphasized that a man without needed glasses is as much a casualty as a wounded soldier. This problem would be more serious for the British than the Americans, because the former have used lower visual standards in their combat forces. He warned against too hasty and too numerous enucleations, and advised that every man with an open wound of the globe be regarded as a litter patient. He did not feel that an implant after enucleation was worth the trouble. Asked for a practical test for night vision to rule out malingering, he recommended ordering the soldier to cross, in the dark, a latrine trench across which there was a single plank. If he fell in, the night blindness was considered genuine.

After lunch, and a photograph of the group had been taken, Air Commodore P. C. Livingston, Chief Ophthalmologist for the R.A.F., gave an excellent talk on "Scototics." Commodore Livingston has for many years been a leader in research on night vision and its application to night flying. The factors involved are many, but the careful screening of night fliers, by such as his hexagon test, and their training in how to see best in the dark, and among searchlights, has proved its value manyfold.

Both the R.A.F. and the U.S.A.F. had exhibits of their ocular equipment for testing, and for use by fliers. Several patients from Moorfields Eye Hospital, London, were demonstrated. The last paper was entitled "Influence on ocular function of oral use of sulfa drugs," read by Major N. S. Rubin (MC), 5th Air Force, who with Capt. Carlisle E. McKee was host and had arranged the meeting.

At a short business meeting Commodore Livingston was elected the fourth Honorary Member of the Society, the others being Brigadier Sir Stewart Duke-Elder, Lt. Commander Edwin Dunphy (U.S.N.), and Sir Ian Fraser.

At the meeting of the Colorado Ophthalmological Society on January 15, 1944, a symposium on contusions to the eye was presented. The following papers were given: "The bony orbit," by Dr. W. T. Brinton; "Conjunctiva and surrounding tissues," by Dr. Samuel Goldhammer; "Anterior segment of the eye," by Dr. Leo Davis; and "Posterior segment of the eye," by Dr. Edna Reynolds.

The eightieth annual meeting of the American Ophthalmological Society will be held at The Homestead, Hot Springs, Virginia, on May 29, 30, 31, 1944.

The members are requested to send to the chairman of the program committee, Dr. Walter I. Lillie, as soon as possible, the titles and brief abstracts of such papers as they desire to present at the meeting before April 15th, to be incorporated in the call for the meeting to be sent out about May 1st.

At a recent meeting of the Indianapolis Ophthalmological Society, Dr. Paul G. Moore, assistant clinical professor of ophthalmology at Western Reserve University School of Medicine, spoke on "The end results following intraocular foreign bodies."

The Los Angeles Society of Ophthalmology and Otolaryngology appointed the following officers for 1944: president, Dr. M. E. Trainor; vice-president, Dr. Kenneth Brandenburg; secretary-treasurer, Dr. Orrie E. Ghrist; and committeewoman, Dr. Etta C. Jeancon.

#### PERSONALS

Among the members of the Philadelphia County Medical Society who were given testimonial certificates for having been in practice 50 years or more was Dr. Burton Chance, Sr.

Dr. William E. Bruner, professor emeritus of ophthalmology, Western Reserve University School of Medicine, Cleveland, celebrated his fiftieth year in the practice of medicine at a dinner on January 4th. He was presented with a silver tray engraved with the names of his guests, his associates at the eye clinic of the old Lakeside Hospital.

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## A NEW TYPE OF PIGMENT LINE IN THE CORNEA\*

FREDERICK W. STOCKER, M.D., AND RONALD E. PRINDLE, M.D.

*Durham, North Carolina*

Many instances of unusual pigmentation of the cornea were observed and described before the slitlamp and the binocular microscope were developed. However, a more accurate knowledge of the conditions in which pigmentation of the cornea might occur and the layers in which the pigment might be deposited was not obtained until careful studies had been carried out with these instruments.

The following types of corneal pigment lines have been described.

1. Fleischer's ring in keratoconus.
2. Senile corneal line (Staehli).
3. Pigment line in pterygium (Stocker).
4. Pigment line in corneal scars; for example, interstitial keratitis (Hudson, Vogt, Hanssen, and others).
5. Kayser-Fleischer ring: pseudosclerosis (Wilson's disease).
6. Krukenberg's spindle.

The first three types present fine pigment lines that have been shown to be located in the very superficial layers of the cornea immediately beneath the epithelium. Vogt<sup>1</sup> and Grueninger<sup>2</sup> have demonstrated that breaks in Bowman's membrane must be considered the site in

which the pigment in a senile corneal pigment line is deposited. Stocker's<sup>3</sup> findings in some cases of pterygium support this theory. These breaks seem to develop when a marked flattening of the cornea occurs, producing astigmatism against the rule, as in old age, keratoconus, and some cases of pterygium.

The fourth type of pigmentation, pigmentation in corneal scars; is not well defined as to its location in the corneal tissue. Often it does not form a distinct line but stains the cornea more diffusely and never has been described as extending from one limbus to the other. Hansen<sup>4</sup> examined microscopically an eye with a corneal scar which *in vivo* had shown pigmentation in its central parts. He found the pigment to be located partly between the epithelial cells, but most of it was deposited between the epithelium and Bowman's membrane, within that membrane, and in the corneal stroma. It never was seen to be located intracellularly.

The Kayser-Fleischer ring in pseudosclerosis is entirely different in appearance from these fine lines. It is much broader, of a yellow reddish color, and the pigment is deposited on Descemet's membrane.

In Krukenberg's spindle and some re-

\* From the Department of Surgery, Ophthalmological Division, Duke Hospital and Duke University Medical School.

Figs. 1 and 2 (Stocker and Prindle). Pigment line in the cornea. Fig. 1. Pigment line across cornea from the 7- to the 5-o'clock position.  
Fig. 2. Slitlamp view of pigment line.

lated cases, as described by Weinkauff,<sup>5</sup> the pigment also is located on Descemet's membrane.

Epithelial melanosis of the cornea as described in nevi of the limbus and in malignant tumors growing from the conjunctiva into the cornea, is excluded from consideration in this paper. Vogt,<sup>6</sup> in his slitlamp Atlas, states that in some cases of nevi of the conjunctiva the pigment may invade the adjacent epithelium.

Concerning the nature of the pigment found in the various types of corneal pigment lines, the following observations have been reported: Fleischer<sup>7</sup> proved that the pigment line in keratoconus is hemosiderin. It is probable that the pigment in the other three of the first four types hereinbefore mentioned is also of hematogenous origin. In his case of pigmentation of a corneal scar Hansen<sup>4</sup> could exclude hemosiderin, but he had no positive suggestion as to the nature of the pigment. The pigment in the Kayser-Fleischer ring in pseudosclerosis is of an entirely different nature. According to Vogt<sup>8</sup> finely dispersed silver seems to be present in most of the cases. Others have reported the presence of copper, zinc, and other heavy metals. In Krukenberg's spindle the pigment is believed to originate from the uveal pigment.

Pigment lines of the cornea are not only of theoretical interest but sometimes of diagnostic value. Therefore, any observation of a heretofore unknown type of corneal pigmentation should be reported. We have had the opportunity to observe a corneal pigment line that differs in several characteristics from all the previously described types.

#### CASE REPORT

L. F. W., 24 years old, a darkly pigmented Negro, was first seen in the Duke Hospital Eye Clinic in early November of 1941, complaining of a painful left

eye. Two weeks previously some "trash" blew into his left eye, which felt irritated for a few hours, but caused no further trouble until four days later when it became red and painful. At about this time he contracted a severe generalized Dermatitis venenata (*Rus toxica*). He believed that this precipitated his eye trouble. Treatment was with eye drops of an unknown character and various skin lotions.

When first seen his dermatitis had completely cleared but the left eye was causing him considerable discomfort. Vision O.D. was 20/30; O.S., light perception. The right eye was essentially normal. In the left eye there was a diffuse hyperemia of the conjunctiva with a rather marked circumcorneal flare. There was extensive brownish pigmentation of the limbus and adjacent conjunctiva. The corneal transparency was slightly decreased. The anterior chamber was deep, the pupil irregular, semidilated, and fixed. The fundus could not be visualized. The tension was slightly elevated. Slit-lamp examination revealed an intact epithelium and normal corneal stroma. There were many deposits on the posterior surface of the cornea, a prominent aqueous flare with numerous cells, and extensive adhesions between the iris and lens.

The family history, past history, and systemic review were noncontributory. Venereal diseases were denied and blood tests were reported as negative by his local physician.

The diagnosis of nonspecific uveitis with secondary glaucoma was made. Hospitalization was advised but had to be postponed for several weeks for financial reasons. He was treated in the meantime with atropine drops and hot compresses.

In December, hospitalization was arranged for a course of hyperpyrexia with

intravenous typhoid "H" antigen. Hot compresses and atropine instillations were continued along with the usual supportive therapy. Physical examination and laboratory workup, including serology and chest X-ray films, were negative. The eye objectively presented little change except for early cataractous changes in the lens. The tension had decreased to normal limits. Subjectively the eye had improved.

The patient was discharged with instructions for instillations of atropine 1 percent, the application of hot compresses, and cod-liver oil to be applied locally and taken orally.

Frequent return visits were impossible because of transportation difficulties. One month later the eye showed much less conjunctival and circumcorneal hyperemia, but there was beginning deep vascularization of the cornea, inferiorly. Keratic precipitates were still numerous and there was a dense aqueous flare. The pupil was unchanged. The condition of the eye had caused no further symptoms other than marked visual loss. Repeated search for a possible focus of infection was negative. During the following months the inflammation gradually subsided, but the infiltration and vascularization of the cornea progressed, especially from below.

Eight months after the first examination the first appearance of a fine brownish line was noted, extending across the cornea from the limbus at the 7-o'clock position to the opposite limbus at five o'clock (fig. 1, frontispiece). Slightly to the nasal side of the center of this line a delicate branch with the same appearance radiated diagonally upward. Grossly, this transverse pigment line appeared to be a continuation of the limbal pigment onto the cornea. Slitlamp examination (fig. 2, frontispiece) confirmed this and showed the pigment to be located in the

very superficial layers of the cornea. Under high magnification this line had a stippled appearance with a definite broad junction with the limbal pigment of the nasal side and a faint threadlike junction with the limbal pigment of the temporal side. There was a rather dense infiltration of the stroma of the lower half of the cornea with very deep vascularization. A faint aqueous flare was still visible but there were no cells. The pupil was slightly eccentric superiorly, oval in shape, and fixed. Tension was normal.

Thirteen months after the original visit the patient returned because of the recurrence of pain in the left eye. Examination was as before but the left eye was now blind. Enucleation with glass ball implantation was performed. Convalescence was uneventful.

The gross and microscopic examination of the enucleated bulb revealed the following findings:

*Gross examination* showed a moderately shrunken bulb. The lower half of the cornea was opaque. A brown pigment line was clearly visible, running horizontally from the nasal to the temporal limbus. Near the center of this line a branch extended upward.

*Microscopic examination* revealed the sclera to be thickened throughout, particularly on the nasal side of the posterior segment. From this area arose a mass of granulation tissue involving the inner layers of the sclera, the choroid, and the retina. A similar but smaller lesion was present on the temporal side. This tissue consisted largely of round and epithelioid cells with a few giant cells. In some areas there was caseation. The retina, in the regions which were not involved in the described process, was detached except for a narrow margin near the ora serrata. The ciliary body and processes were atrophic. The angle of the anterior chamber was obliterated by adhesions of the



peripheral margin of the iris to the posterior surface of the cornea. The pupillary margin was adherent to the anterior lens capsule. The iris showed considerable round and epithelioid-cell infiltration.

At the limbus, the corneal epithelium

cells and in places round-cell infiltration. A few small blood vessels could be seen in the stroma, but no connection of the pigmentation with the vascularization could be demonstrated.

In accordance with the direction in

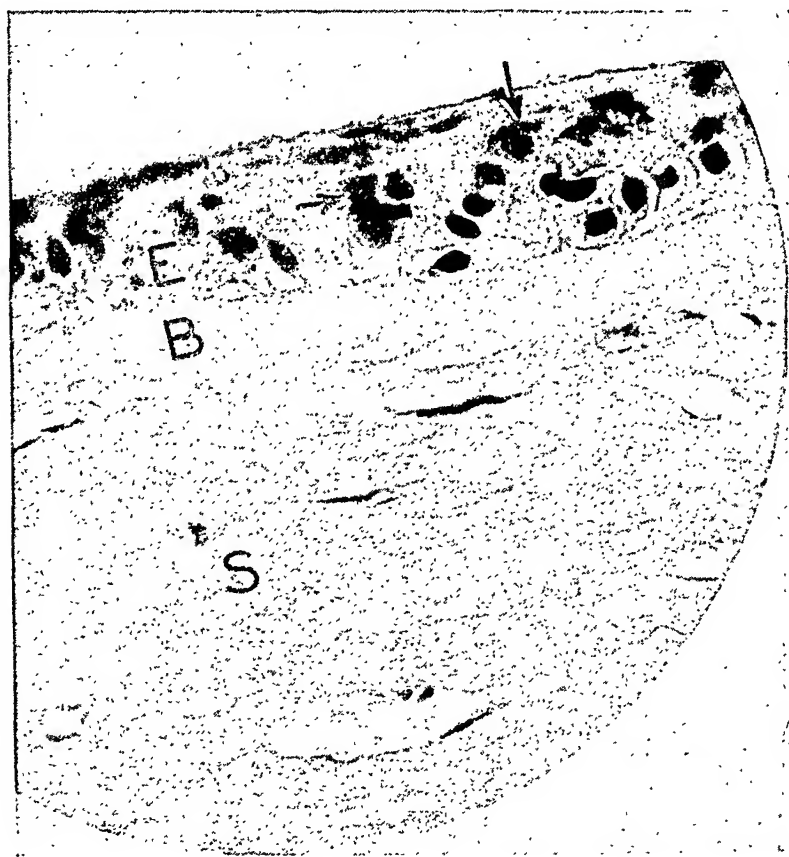


Fig. 3 (Stocker and Prindle). Section through cornea, high magnification. E, epithelium; B, Bowman's membrane; S, stroma. Arrows show pigment located in epithelial cells.

appeared thickened. The cells in the basal and medial layers contained considerable brown pigment. The architecture of the corneal epithelium was not markedly disturbed and showed the normal arrangement of a basal layer of cylindrical and cuboidal cells and a superficial layer of flattened cells. In a small area near the center of the cornea, the basal cells contained large brown pigment granules. Small amounts of this pigment were seen in a few of the superficial cells (fig. 3). It had the same appearance as the limbal pigment. It did not react to iron stain. The corneal thickness was about normal. There was an increase in the number of

which the eyeball was sectioned, this pigment area must be identical with the pigment line observed macroscopically. Bowman's membrane was intact throughout. No pigment was found on, in, or beneath this membrane, nor in the stroma.

The pathologic picture was most suggestive of tuberculosis, although no tubercle bacilli were demonstrable.

The pigment which was found in the corneal epithelium was not hemosiderin, as in Fleischer's ring, since it did not stain by the Berlin blue method. Most probably it was melanin, since the corneal pigmentation was continuous with the pigment of the limbus.

### DISCUSSION

How does this melanotic pigment establish itself in the corneal epithelium and why does it form such a very fine line instead of invading the cornea diffusely? It is well known that, in the Negro, inflammation is commonly associated with abundant pigment formation. Therefore, the appearance of pigment in the cornea, which to a certain extent was involved in the extensive inflammatory process of the whole eye, is not surprising. Why the pigment does not invade the cornea diffusely or along the blood vessels is more difficult to explain. The horizontal senile line and the line seen in pterygium could be explained by a flattening of the cornea in one direction, causing a break in Bowman's membrane. Since in our case the pigment was located in the corneal epithelial cells, and Bowman's membrane was intact, this explanation would not apply. As the principal pigment line in our case was located in the palpebral fissure where light had the most access to the cornea, the hypothesis might be advanced that the melanin was formed

by the action of irradiation on some premelanotic substance originating from the inflammatory process. Unfortunately, we were not able to test the dopa reaction, which might have thrown some light upon that problem, for we were unable to get the necessary reagents.

### SUMMARY

1. A previously undescribed type of corneal pigment line is reported in the eye of a Negro which had been the site of a severe inflammatory process, probably tuberculosis.

2. The pigment has been demonstrated histologically to be located within the corneal epithelial cells. Bowman's membrane was intact throughout and both this membrane and the corneal stroma were free of pigment.

3. The pigment does not take the iron stain and is considered to be melanin.

We are indebted to I. N. Dubin, M.D., of the Department of Pathology, for his technical assistance in the preparation and sectioning of the eyeball.

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# AN OPHTHALMOLOGIC REVIEW OF MORE THAN TWENTY THOUSAND MEN AT THE ALTOONA INDUCTION CENTER

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The opportunity to study a group of 21,446 men examined at the Altoona Induction Station, over a period of months, gives a rare picture in the eye findings in young men between the ages of 17 and 44 years, as found in central Pennsylvania. These men were examined in daily order, no attempt being made to select a particular group. Such a record could not be obtained from a study of cases coming into the office, for the patient who makes an appointment with an ophthalmologist usually suspects a need of visual correction, or has some ocular disease. Five thousand of the men between the ages of 17 to 21 were classified separately, in an effort to determine if the younger men had any marked variation in percentage of eye defects. The record does not show this to be so. Consequently, the discussion covers the group as a whole.

The men are from the counties of Blair, Bedford, Clearfield, Centre, Cambria, Sommerset, Indiana, Huntingdon, Mifflin, and Clinton. This area represents an ideal cross section of Pennsylvania, for at least five of the counties contain very few foreign born or children of foreign-born parents, whereas the remainder of Pennsylvania has a high percentage of this stock. Farming, coal-mining, heavy-metal, and other types of industry are about equally divided; only four cities have a population of over 10,000.

In this review only men with 20/40 or less vision were considered, as this was the army standard for acceptable vision. There were many others whose vision ranged from 20/40 to 20/20. In this age group hyperopia is not fairly shown, for the men still have active accommodation. Naturally, only those with high errors of

hyperopia have 20/40 or less vision.

Aphakia was not listed, but the eye, if aphakic, was placed under the heading of congenital or traumatic cataract as originally acquired.

Corneal scars were considered only if a loss of vision to 20/40 or less was present.

Refractive errors led in cause of defects, with 16.07 percent. We were unable to find that the family status had any bearing as a causative factor. Diet apparently was not a factor, as rich or poor appeared to be equally affected with myopia, squint, and amblyopia. The children of old American stock seemed to have a higher incidence of myopia as compared to those of foreign parentage. Amblyopia was no respecter of nationality. High hyperopia was found more frequently in the Italian.

We were surprised at the figures for amblyopia without squint, for 2.39 percent were amblyopic and only 0.75 percent of these had squint. Amblyopia in this study is 20/70 or less vision, corrected. We had thought from our office practice and reading that amblyopia is more frequently associated with squint. The findings do not substantiate our idea of this relationship.

Many of the men who had refractive errors, had never had glasses, and an equal number had glasses and would not wear them. This examination definitely shows that a young man, unless willing, does not wear glasses, and apparently no amount of education can change his mind. Men with high errors of refraction frequently had left their spectacles at home or wore them in their pockets. Others had never troubled themselves to obtain

TABLE 1

AN OPHTHALMOLOGIC REVIEW OF TWENTY THOUSAND MEN AT THE ALTOONA INDUCTION CENTER

	Age 17-21- incl. 5,575	Per- centage	Age 22-44 incl. 15,871	Per- centage	All Ages 21,446	Per- centage
<i>Refractive Defects</i>						
Low myopia—20/40 or less	462	8.30	1,059	6.67	1,521	7.09
High myopia—20/200 or less	151	2.71	652	4.11	803	3.74
High hyperopia—20/40 or less	226	4.05	638	4.02	864	4.03
Mixed astigmatism—20/40 or less	22	0.39	29	0.183	51	0.238
Convergent squint with amblyopia	16	0.29	95	0.598	111	0.517
Convergent squint without amblyopia	3	0.054	12	0.076	15	0.070
Convergent alternating squint	4	0.072	15	0.094	19	0.088
Divergent squint with amblyopia	8	0.143	42	0.265	50	0.233
Divergent squint without amblyopia	2	0.036	9	0.057	11	0.051
Divergent alternating squint			1	0.006	1	0.005
TOTAL					3,446	16.07
<i>Congenital Defects</i>						
Albinism			2	0.013	2	0.009
Amblyopia, 20/70 or less	102	1.83	412	2.59	514	2.39
Bilateral chorioretinitis			1	0.006	1	0.005
Buphthalmos	1	0.018	1	0.006	2	0.009
Cataract	3	0.054	28	0.176	31	0.144
Coloboma of iris			2	0.013	2	0.009
Cyst of sclera			1	0.006	1	0.005
Microphthalmos			1	0.006	1	0.005
Nystagmus	7	0.126	36	0.227	43	0.201
Optic atrophy			2	0.013	2	0.009
Persistent tunica vasculosa lentis			2	0.013	2	0.009
Ptosis	2	0.036	6	0.038	8	0.037
TOTAL					609	2.84
<i>Traumatic Injuries</i>						
Cataract	12	0.215	102	0.643	114	0.532
Chorioretinitis	5	0.090	28	0.176	33	0.154
Corneal scar	4	0.072	61	0.384	65	0.303
Ectropion			1	0.006	1	0.005
Enucleation	3	0.054	41	0.258	44	0.205
Intraocular foreign bodies	1	0.018	1	0.006	2	0.009
Iridodialysis	1	0.018	8	0.05	9	0.042
Luxated lens			1	0.006	1	0.005
Optic atrophy	6	0.108	21	0.132	27	0.126
Paralysis of external rectus	1	0.018			1	0.005
Phthisis bulbi	2	0.036	21	0.132	23	0.107
TOTAL					320	1.49
<i>Ocular Diseases</i>						
Blepharitis	7	0.126	5	0.032	12	0.056
Chalazion	1	0.018	2	0.013	3	0.014
Chorioretinitis	21	0.38	66	0.416	87	0.406
Complicated cataract	6	0.107	7	0.044	13	0.061
Congestive secondary glaucoma	1	0.018	3	0.019	4	0.018
Conjunctivitis	3	0.054	1	0.006	4	0.018
Detachment of retina	2	0.036	11	0.069	13	0.061
Diabetic retinitis			1	0.006	1	0.005
Epicanthus	2	0.036			2	0.009
Exophthalmos, toxic	2	0.036	3	0.019	5	0.023
Familial macular degeneration			2	0.013	2	0.009
Interstitial keratitis	3	0.054			3	0.014
Iritis and uveitis	4	0.072	7	0.044	11	0.051
Keratitis	1	0.018	2	0.013	3	0.014
Keratoconus	1	0.018	2	0.013	3	0.014
Monocular exophthalmos	1	0.018			1	0.005
Myopic chorioretinitis	2	0.036	16	0.101	18	0.084
Optic atrophy	2	0.036	9	0.057	11	0.051
Pterygium			9	0.057	9	0.042
Retinitis pigmentosa	1	0.036			1	0.005
TOTAL					206	0.961
Total Defects					4,581	21.36

glasses, and, in many instances, not through lack of funds, as agencies furnish glasses throughout most of these counties. A surprising number of men were wearing from plano to plus 0.25D. sphere.

Congenital defects (omitting amblyopia) were only 0.43 percent, congenital cataract being the leader with 0.144 percent. These figures were not excessive and speak well for this group.

Traumatic injuries are the disgrace of childhood; they are in many cases the result of carelessness, usually in the home. The history of injury with scissors, knives, air rifles, and arrows, all too well explains the traumatic cataracts or enucleations. No industry would permit such an appalling figure among so relatively small a group. In fact very few of these men obtained their ocular injury in industry. We are at a loss as to the best educational method to suggest in preventing this waste of sight. A mother with many children cannot always watch what a child is doing, but it is certain that scissors and knives should not be among accepted children's toys. Apparently surgical care of these cases has been adequate and well done.

Among the ocular diseases blepharitis, conjunctivitis, and chalazia were very low. The chorioretinitis and uveitis cases were the usual focal-infection type and comprised 0.456 percent. Often these men

had never seen a physician, or, if treated, had in many instances poor medical care, as no search for focal infection had been made. This is particularly true of the rural population.

History of trauma could seldom be obtained in the detachment cases, so they were listed under acquired diseases. Only one case had a history of operation.

Five cases of toxic exophthalmos was rather high among this age group; two of these men had been operated upon. As compared with office practice the number of cases of interstitial keratitis was low. Optic atrophy was frequently associated with chorioretinitis. Retinitis pigmentosa was probably higher than is here shown, for an eyeground study was not made in all cases.

The cases of familial macular degeneration were in brothers. The number of cases of myopic chorioretinitis, 0.884 percent, was high, but this would naturally be expected as the number of men with high myopia was large.

#### CONCLUSION

Of 21,446 men going through the Altoona Induction Station, a total of 21.36 percent had eye defects that lowered vision to 20/40 or less. This, excepting hyperopia, represents a fair cross section of eye defects in central Pennsylvania.

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## THE FORM AND CHARACTER OF ROD SCOTOMETRY

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Dark-room field testing is not in itself new. The method in the main has aimed at excluding extraneous effects likely to induce attention waver. Detailed consideration does not appear to have been given to the encouragement of rod response only, while calling upon the cones to fulfill the role of central fixation. So far, instruments have appeared designed with controlled sources of electric light for fixation object and for target. It is not easy to obtain a lighted target of a value that lies safely below cone threshold. A mechanism involving rheostatic control with the addition of filters is then necessary to influence both the luminosity and the color temperature. As complications multiply, so does expense increase and mobility become restricted.

To circumvent these difficulties, an alternative method has been sought, with a view to obtaining freedom from mechanical adjustment. Anticipation on the part of the patient, such as is encouraged by the rattle of cogs and the exactness with which the target arrives over the various areas, tends to produce an artificial atmosphere and restrict freedom on the part of the operator.

The problems that surround night vision have provided numerous avenues of approach. In the present instance it was believed that, in the dark-adapted retina, results might be achieved outside the range of standard procedures. Under the usual conditions that surround perimetry or scotometry, the hands of the examiner even though covered with black gloves, cannot be perfectly obscured. The unavoidable differences in background brightnesses between target holder and screen; shadows; the uncertainty regard-

ing the exact point of appearance of the target, all influence the eventual records. As so frequently happens, these influences become more significant when it is of special importance to obtain accurate evidence regarding the nature of a suspected defect while in its earliest stages of development.

The introduction, in the Ophthalmic Department of the Royal Air Force, of self-luminous targets for visual tests in absolute darkness dates from 1935. At that time, attempts were made to learn the extent of form recognition adjacent to the fixation point as compared with form perception divorced from analysis. The conditions of illumination of the objects for identification varied between 0.0002 e.f.c. and 0.5 e.f.c. The self-luminous discs for these experiments were employed for purposes of fixation and were thus a little above cone level. These were moved over an arc at the center of which was a circular frosted-glass screen of 2-inch aperture, in which silhouettes of varying character, such as aircraft, ships, and crosses could be exposed for recognition.

Later, in 1940, work was commenced in which luminous objects now at rod level became the targets, while a red light, the luminosity of which carried well into cone function, acted as the point of fixation. Thus, a system of scotopic scotometry developed. The scope for this technique within the realm of clinical ophthalmology now becomes of widening significance.

### APPARATUS

The apparatus at this stage of development, consists of a one-meter Bjerrums screen, suspended from a central metal

pole. It is fixed in a strong frame that allows it to be firmly and evenly stretched in all directions. This facilitates the passage of the pins through the cloth without disturbance of the position of the screen. The side of the screen facing the patient is marked out in dots of white and red paint. The white dots indicate each degree and pass in a fan divided into 10-degree sectors from the fixation point to the periphery. The red dots run in circles around the fixation point and appear every five degrees. Such an arrangement simplifies the transfer of the record to the scotoma chart. As the test is carried out in complete darkness no adverse effects occur from the presence of the large number of dots. The fixation point is provided by a red light, from a 4-V dry-cell battery fitted to the stand. The bulb is set in a light-trapped black metal tube, so that, when burning, there is no escape of light except through the aperture providing the fixation point. By a suitable system of baffling, the pencil of light is lost to sight should the fixating eye commence to wander, a fairly common experience in dark-room studies of visual function. Refixation after wandering is readily encouraged. Provision is made for the adjustment of the height of the fixation tube so that each subject can be seated with eye height accurately adjusted to the pencil of red light. The character of the red light is important. It should be represented by a 1-mm. pencil shining through a rather deep-red filter approaching Wratten 89A. In trapping the source of the fixation light so that no movement of the field margin can come about, it is important to exercise care in the design of the tube baffles and also to employ for the chosen color a form of red that is attractive to the cones, but exercises the least possible effect upon the rods. Traquair's target holder was modified so that a target could be fitted to either end. It was also

strengthened, and metal caps were made to cover the self-luminous targets when they were carried through lighted rooms. This modification permits suitable freedom of movement by the operator. The self-luminous targets are composed of radium paint treated with varnish so as to vary the candle powers. The expression "candle power" seems rather overwhelming in view of the infinitely reduced power of the light source, but after due consideration it was voted the best form of expression. A suitable range of luminosity for screen testing is found to lie between  $6 \times 10^{-9}$  and  $40 \times 10^{-9}$  candle power in sizes of 1, 2.5, and 5 mm. The targets must be kept in the dark. Should exposure to light take place, a change in brightness occurs and the work should be postponed until the target has been replaced in darkness for one hour. The life of these targets without appreciable alteration in brightness can, it is said, be counted in years. For plotting, colored glass-headed pins are employed, so that when two or three tests are undertaken during the same period of darkness, no confusion arises during transfer of the record to the chart after the room light is turned on.

#### PREPARATION AND TEST

For this test to be of value, it is essential that the room in which it is conducted can be made completely dark. First, a routine screen examination is carried out in daylight. It is then explained that the principle of the test will be repeated in darkness, that a red light will substitute the white fixation spot, and a self-luminous target will replace the white test object. The subject wears dark neutral adaptation goggles of a light transmission of 3 percent (fig. 1). Adaptation is carried on for 30 minutes, and there is an added period in the dark room of 5 minutes to accustom the patient to the situation. It is



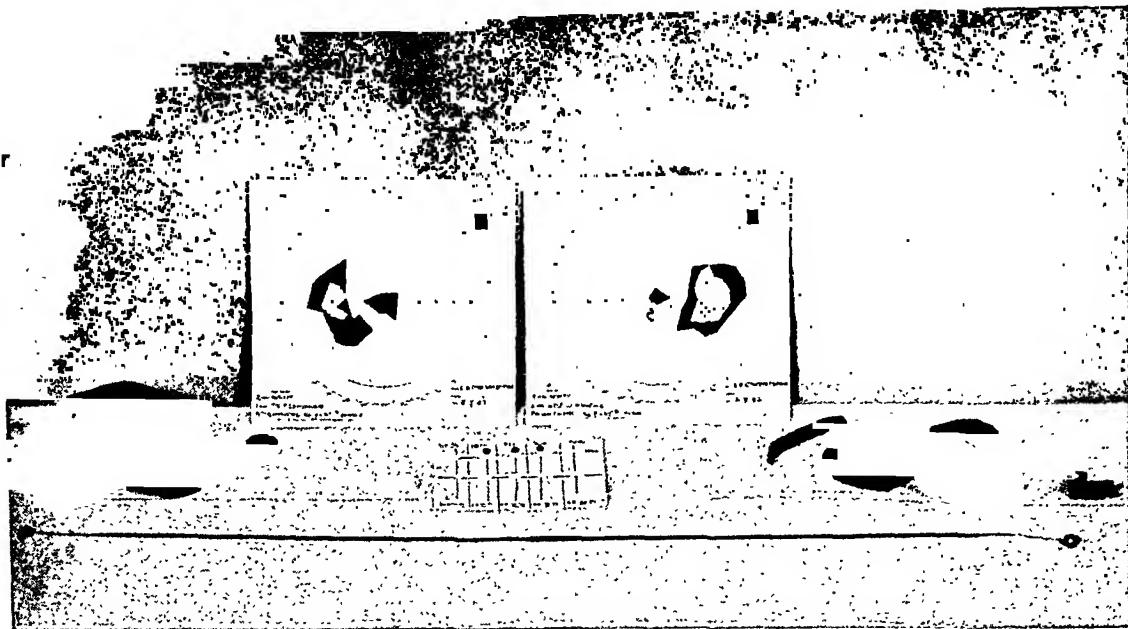


Fig. 1 (Livingston). Showing the patient's adaptation goggles on the left, the operator's goggles on the right, the test holder with two radium targets, a standard series of targets in folder, and two fields of vision. The fields here shown resulted from the examination of a case of papilledema. Note the considerable increase in the size of the blind spot (black) when examined in the dark, compared with the blind spot (crosses), by daylight testing. The dark method has revealed a spread in the exudate.

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better, although not essential, for two operators to work together plotting the field, one moving the target the other marking with the colored pins. By this procedure, a minimum of disturbance takes place and the operator with the target can devote his time to concentrating upon the field area according to the nature of the case before him. The operators should prepare by adapting behind red goggles in which a neutral filter has been incorporated. The light transmission is approximately 4 percent. Red-neutral goggles are useful as they permit more latitude of movement during adaptation and do not prevent work being continued. Fifteen minutes of adaptation suffices, because full stability is not required by the operator, as with custom much skill in picking up the target, using wide eccentric fixation, can be acquired. The trick of fixating about 15 degrees away from the target soon becomes a habit. It is rarely found that the patient ex-

periences difficulties. The target should be moved slowly and steadily. A check upon the patient's attention and understanding can be provided by turning the target over, thus extinguishing the source of light. This effect is much more absolute than is experienced with the daylight technique. The margins of perception are sharp, so that the point of loss and reappearance of the target can be verified without any need to change the original pin positions.

#### RESULTS AND INTERPRETATIONS

*Physiologic features.* Targets below cone threshold produce a central scotoma, the area of which is normally enclosed within a circle of 2 to 3 degrees. It is sometimes found that the scotoma is oval or egg shaped, with its major spread lying in the horizontal axis (fig. 2). The blind spot is always larger than that recorded in daylight. The explanation, no doubt, lies in the state of myelination of

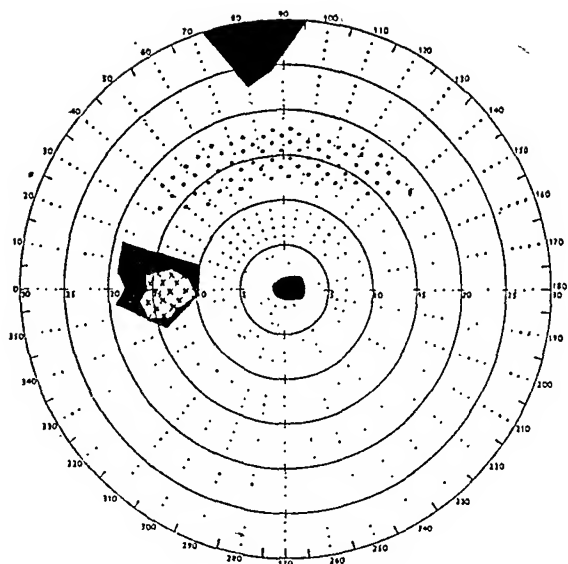


Fig. 2 (Livingston). This field exhibits the characteristic features found in normality at ground level. These are: (a) egg-shaped central scotomata, long axis, horizontal; (b) increase in blind spot over that found by daylight test; (c) presence of area of increased rod sensitivity indicated by dots; (d) triangular scotoma apex down lying between 70 degrees and 95 degrees, 23 degrees from the fixation point.

Test objects: 2 mm. white; 2 mm. self-luminous; brightness = 0.000000007 f.c.

Crosses = ground level, lights on; solid black = ground level, lights off, after 45 minutes dark adaptation; dots = area of rod hypersensitivity. Vision 6/6 6/6; date January 12, 1943.

Fig. 3 (Livingston). The effect of anoxemia upon a resistant subject. Observe the slight increase in the size of the blind spot and also the central scotoma. Compare this with figure 4.

Test objects: 2 mm. white; 2 mm. self-luminous; brightness = 0.000000003 f.c.

Crosses = ground level, lights on; solid black = ground level, lights off, after 50 minutes dark adaptation; cross-hatching = at 17,000 feet, after 35 minutes at that altitude. Vision 6/6 6/6; date February 24, 1943.

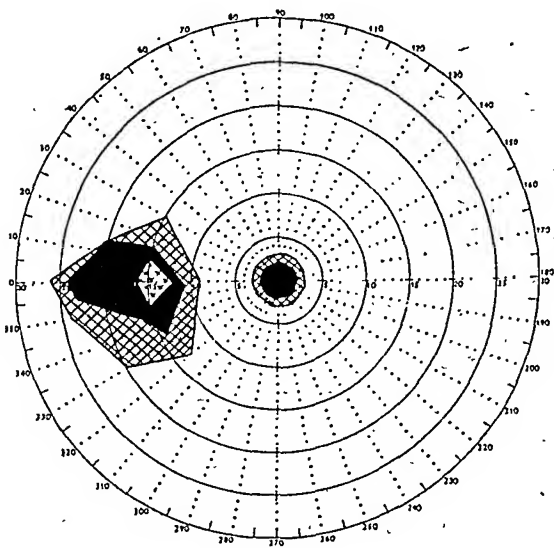
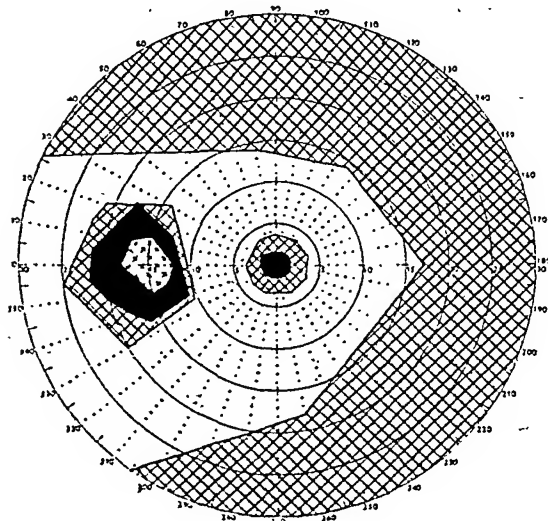


Fig. 4 (Livingston). The effect of anoxemia upon a normal but susceptible subject. Note the brief period of 15 minutes at 17,000 feet which has revealed an extensive contraction. Compare this with figure 3 when the subject was exposed for 35 minutes at the same altitude, and revealed no peripheral contraction.

Crosses = ground level, lights on; solid black = ground level, lights off, after 50 minutes dark adaptation.

Test objects: 2 mm. white; 2 mm. self-luminous; brightness = 0.000000003 f.c. Vision 6/6 6/6; date February 3, 1943.



the nerve fibers at the disc. As the stimulus is extremely delicate it fails to excite a reaction which would be elicited in the light. If a very small target of say  $7^{10-9}$  candle power is employed, it is found possible to plot the course of the chief retinal vessels. To effect this, the target is passed backward and forward across the vessels, with a slow movement of narrow amplitude. Toward the periphery of the screen, a scotoma appears in about 20 percent of cases. This begins above the fixation point, starting some 20 degrees out; it is triangular in shape with its apex pointing downward. This may be regarded as representing a remnant of the secondary optic vesicle in which no abnormal ophthalmoscopic appearances can be observed. An area of high rod sensitivity is found 12 to 18 degrees outward and upward. It has been shown to coincide with histologic patterns, which are reported by Østerberg to form a more or less complete ring about the macula. This

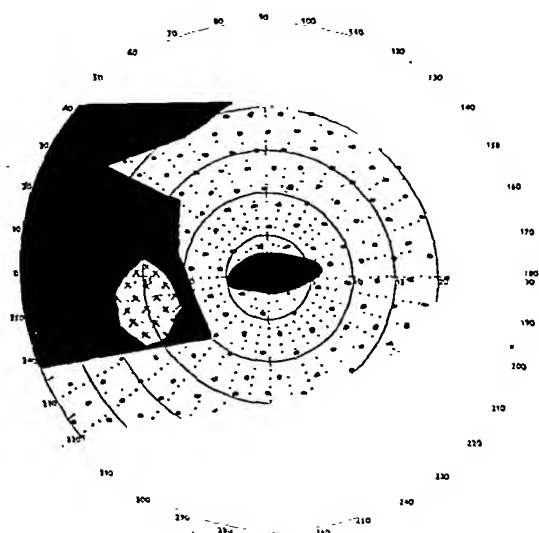


Fig. 5 (Livingston). The field in an early stage of vitamin-A deficiency, showing defects in the form of paracentral contraction combined with enlargement of the central scotoma. Test objects: 2 mm. white; 2 mm. self luminous; brightness = 0.000000013 and 0.000000006 f.c. Crosses = normal blind spot, day, 2 mm. white; solid black = central scotoma, peripheral contraction, target 0.000000006; dots = insensitive over whole area, target 0.000000013.

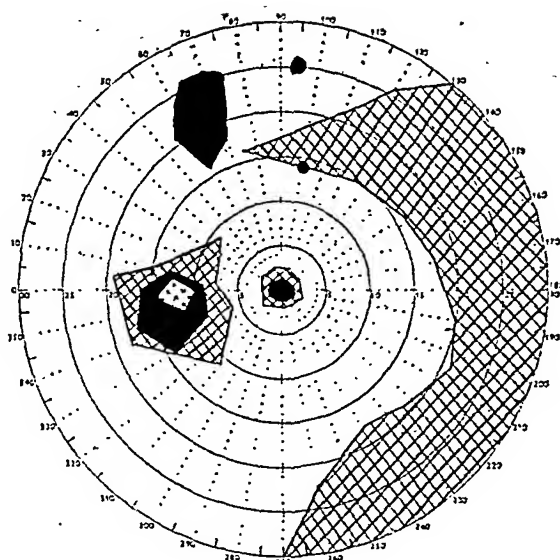


Fig. 6 (Livingston). A diabetic subject since 1939—insulin until 1942—now on restricted carbohydrate diet. Sugar 1+.

Field of vision ground level, shows two characteristic small circular scotomata. The third and larger scotoma may be associated with the congenital closure defect described in the text. At 15,000 feet after 15 minutes, a relatively big contraction of the field of vision is revealed. This is considered quite abnormal for the altitude and exposure time recorded. The majority of diabetic subjects are more susceptible to anoxemia than are normal subjects.

Crosses = ground level, lights on; solid black = ground level, lights off, after 45 minutes dark adaptation; cross hatch = at 15,000 feet, after 15 minutes at that altitude.

Test objects: 2 mm. white; 2 mm. self-luminous; brightness = 0.000000003 f.c. Vision 6/6 6/6; date June 17, 1942.

zone of hypersensitivity encircles the fixation point.

*Physio-pathologic features.* A contraction of the field with an enlargement of the macular scotoma and blind spot, is found in anoxemia when brought about in the low-pressure chamber (fig. 3). Changes in the field become evident after 20 minutes at an altitude of 17,000 feet. The reaction is a delicate one with a wide variation between different subjects (fig. 4). Defects, in the form of paracentral contraction, combined with enlargement of the central scotoma, may appear at an

(Concluded on page 428)

## OCULAR ROSACEA AND ARIBOFLAVINOSIS

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Coincidentally with the publication in this Journal of Wise's thesis on "Ocular rosacea"<sup>1</sup> comes a further contribution to the subject from Conners, Eckardt, and Johnson.<sup>2</sup>

Wise's researches into the etiology of this disease cover a wide field, whereas the investigations of the Cleveland group are mainly confined to the biochemistry of riboflavin, its excretion by rosacea subjects, and the treatment of such cases by vitamin B<sub>2</sub> therapy, although in previous papers they have published statistics of gastric analyses<sup>3</sup> and touched upon the possibility of a Demodex factor in ocular rosacea.<sup>4</sup>

On almost all points the findings of Wise and of the Cleveland group are diametrically opposed; two points, including one of fundamental importance, are mentioned by neither. It is on this point—namely, the type of corneal vascularization found in ariboflavinosis<sup>5</sup> and not found in ocular rosacea—that a series of clinical investigations carried out by the present writer<sup>6</sup> may fill a gap. Incidentally, they demonstrate the other point omitted by Wise and the Cleveland investigators; namely, that, at least in Oxford, rosacea is characterized by a marked seasonal incidence.

During routine slitlamp examination of sections of the population of England with the Oxford Nutrition Survey in 1942, although some cases of ariboflavinosis were found, there were none of ocular rosacea; but at the Oxford Eye Hospital the "rosacea season" was just beginning, and all such patients were examined with the slitlamp. They were divided into two groups, unilateral and bi-

lateral, in order to obtain, in the former group, a control eye per patient in which to look for the type of corneal vascularization constant in ariboflavinosis, unmasked by corneal infiltration or ulceration.

It was assumed that if ocular rosacea were the direct result of riboflavin deficiency, as stated by Johnson and Eckardt, these rosacea patients would show the specific type of corneal vascularization characteristic of ariboflavinosis. This is always bilateral, though not always equally advanced in both eyes; it is always symmetrical—that is, it invades the whole circumference of the cornea in both eyes, although, owing to the sclerocorneal "overlap" in the segment of the cornea covered by the upper lid it is rarely conspicuous there; it forms a more or less regular pattern of very fine, streamerlike superficial vessels which proliferate from the limbic loops of the pericorneal plexus and unite to form new tiers or arcades in the clear corneal substance, sometimes encroaching almost to the pupillary area. This stage is best seen by retroillumination. Circumcorneal injection is frequently absent until a late stage, when deep vascularization and corneal opacities may appear, with, in some cases, iritis. The picture in an early stage is entirely unlike that of ocular rosacea with its irregular, localized infiltrates that progress across the cornea just ahead of a leash of vessels and separated from them by a clear space. In later stages of both conditions the deep vascularization may be the result of secondary sepsis, but in the only two severe cases of ariboflavinosis seen in Oxford the corneal opacities

TABLE 1

SLITLAMP EXAMINATION OF 45 CASES OF DERMATOLOGIC ROSACEA

	Unilateral Ocular Rosacea	Bilateral Ocular Rosacea	No Ocular Rosacea
Corneal vascularization, B <sub>2</sub> type, present.	0	0	1(a)
Corneal vascularization, B <sub>2</sub> type, absent.	40	3	1(b)

Corneal vascularization, B<sub>2</sub> type = the bilateral, symmetrical type found in ariboflavinosis (with or without the irregular, localized type found in ocular rosacea).

were symmetrical, and there was much less local vascularization than would have been present in ocular rosacea of this degree.

Table 1 shows the result of slitlamp examination of 45 cases of dermatologic rosacea, in 43 of which there was ocular rosacea.

Of these 45 cases only one—case 1(a)—showed the B<sub>2</sub> type of vascularization. In this case, although there was mild cutaneous rosacea, there was no ocular involvement from it. Within a month, the cornea became almost normal on B<sub>2</sub> therapy, the new vessels being visible only as "ghosts." The cutaneous rosacea was unaffected.

Case 1(b) showed slight cutaneous rosacea without any corneal or other ocular abnormality and was not treated.

#### INCIDENCE

*Seasonal incidence.* Spring and early summer brought 42 cases under observation, midsummer only 1, and autumn, 2.

*Sex incidence.* Of the 45 patients, only 2 were males.

*Age incidence.* The youngest patient was 24 years old, the oldest 76. The average was 45 to 55 years.

#### THERAPEUTIC TEST

After slitlamp examination 20 of the patients were taken at random and divided in two groups, 10 in each. Group A received riboflavin only. Group B received routine treatment without riboflavin. Subsequently group A, having failed to respond to B<sub>2</sub> therapy, was given routine treatment in addition to riboflavin. The 23 remaining patients in group C received routine treatment and riboflavin, as shown in table 2.

The rate of healing varied with the severity of the lesion rather than with the age of the patient, although naturally most of the severe cases were among the older patients, owing to previous attacks of keratitis. These were the cases most prone to secondary sepsis. The addition

TABLE 2

RESULTS OF TREATMENT OF 45 CASES OF DERMATOLOGIC ROSACEA

Number of Cases	Treatment	Response
10 Group A	Riboflavin only	No improvement or exacerbation
10 Group B	Routine only	Healed
10 Group A	Routine and Riboflavin	Healed
23 Group C	Routine and Riboflavin	Healed
1 (a)	Riboflavin only	Healed
1 (b)	None	None

of riboflavin to routine treatment did not increase the rate of healing.

Probably the deprivation of mydriatics and antiseptics under test conditions accounts for the exacerbations in group A when on riboflavin only, although Johnson and Eckardt state that ocular rosacea clears up within four days on riboflavin. On the other hand, Wise found no improvement after very large doses of vitamin B<sub>2</sub> administered both orally and intravenously over periods of some six weeks or more; on the contrary, some of the lesions flared up. The Oxford patients received 9 mg. of riboflavin orally per day for one or two weeks—until, in fact,

it became apparent that it would be unwise to risk further deterioration of the cornea by depriving them of other treatment. Cases of ariboflavinosis—apart from rosacea—do not often respond promptly to B<sub>2</sub> therapy when, although mild, they are of long standing, but exacerbation during treatment is rarely if ever seen.

Routine treatment for ocular rosacea consisted of mydriatics where indicated, antiseptic lotions or drops for the eyes, dark glasses, sulpho-calamine lotion for the skin, dilute hydrochloric acid to be sipped with meals in cases suspected of gastric dysfunction, and, in selected cases,

#### CONCLUSIONS

Wise, New York	Johnson & Eckhardt, Cleveland	Fish, Oxford
Ocular rosacea follows facial rosacea and both are manifestations of the same disease.	The incidence of rosacea keratitis without acne is so much greater that the occurrence with it is now considered almost a coincidence.	Same as Wise.
Rosacea is not a manifestation of riboflavin deficiency.	Rosacea keratitis is the direct result of riboflavin deficiency.	Same as Wise.
Except in . . . rare cases . . . most of the distressing symptoms and sequelae of ocular rosacea are due to secondary infection with staphylococci.	(There is) absence of the bacterial conjunctivitis which is said to be the initiating factor in catarrhal ulcers. <sup>7</sup>	Same as Wise.
The secondary infection in ocular rosacea can be controlled in almost all cases with a 5-percent sulfathiazole or sulfadiazine ointment used several times a day.		The secondary infection can be controlled by 10-percent albucid drops applied locally three or four times daily.
Rosacea probably is due to some factor causing vasodilatation in the facial area.		Same as Wise.
	The triangular characteristic of the superficial capillaries remains as the sole differential criterion. <sup>7</sup>	The triangular area of vascularization is characteristic of ocular rosacea but not of ariboflavinosis, nor is the B <sub>2</sub> type of vascularization present in rosacea.
Very large doses of riboflavin were given, in some cases over lengthy periods.	In addition to riboflavin, vitamin-B-complex was given, one teaspoonful of which contains therapeutic amounts of the whole B complex. Eggs, liver and milk were added to the diet.	Riboflavin was given only in a series of controlled cases. No special diet nor other treatment of any kind was given to these 10 patients in Group A until exacerbation became dangerous.

peritomy, tonsillectomy, or meibomian massage through the lids; 10 percent albugid (sulphacetamide) drops are now being used with good results, and treatment for seborrhoea capitis given in some cases.

All the Oxford patients had cutaneous rosacea but only one of them, case 1(a), appeared to be on a B<sub>2</sub>-deficient diet; many were farmers and had more milk, butter, eggs, and vegetables than the average citizen. In the Cleveland series of 36 patients only 9 had "some cutaneous type of rosacea," and 34 were on a diet deficient in eggs, liver, and milk. Only one of the Oxford patients, the oldest, had iritis. The youngest patient, with a refractory case, did well after tonsillectomy. Three of the worst cases had recurrent meibomian infection and derived great benefit from meibomian massage; staphylococci were present in the expressed secretion, but no Demodex were found. Two very severe cases, both unilateral, required repeated peritomy. All the patients reported exacerbations when the eyes became sticky and secondary infection was obvious.

It seems probable that, in the Cleveland series of cases, the beneficial results attributed to riboflavin may have been due to the combined effect of all the constituents of the B-complex together with generally improved diet.

Biochemical research in the concentration of riboflavin in ocular tissue<sup>8</sup> leads one to expect improvement in ocular rosacea from B<sub>2</sub> therapy, but neither slit-lamp examination nor therapeutic tests confirm the claim that this disease is due

to a deficiency of riboflavin.

Note: J. H. Duggart, in a paper on "Ocular rosacea" (Trans. Ophth. Soc., 1930, v. 1, pp. 98-109), describes an "encroachment of conjunctival vessels for a varying distance in the cornea, not only in the situation of definite infiltrates, but around its whole circumference," and figure II, reproduced in Duke-Elder's Textbook of ophthalmology, v. II, p. 1724, shows the typical corneal vascularization of ariboflavinosis with superimposed ocular rosacea. I have never seen both these types of vascularization, as thus depicted, in the same eye.

I should like to express my appreciation of the help given in this work by Prof. V. P. Sydenstricker, of the Georgia School of Medicine, Augusta, Georgia, who examined seven of the cases, including case 1(a); Miss Ida Mann, Mr. A. C. L. Houlton, and other colleagues at the Oxford Eye Hospital; Mrs. Pirie, of the Nuffield Laboratory, Oxford Eye Hospital; Dr. Hugh Sinclair and colleagues at the Oxford Nutrition Survey; Dr. Alice Carleton, of the Department of Dermatology, and Dr. Roy Vollum, of the Department of Bacteriology, Radcliffe Infirmary, Oxford.

I am indebted to Dr. V. P. Sydenstricker for the information that ocular rosacea is a rare disease in the southern states of America, whereas ariboflavinosis is—or was—not uncommon there; also for kindly correcting the proofs of this paper.

*"The Cardinal's Hat," 6 Holywell.*

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## THE PSYCHOGENIC COLOR FIELD

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Color fields have been used for some time in relation to organic disease of the eye, but the purpose of this article is to show that they have a possible application in the field of psychosomatic medicine. Traquair and Peter have shown that in certain types of individuals form fields may be either restricted, or of the spiral type. But the present writer has not seen a report of the application of color fields

to those who have a psychogenic factor.

As already mentioned colors are sometimes used to determine the extent of lesions of the retina and nerve. For example, in retinal detachments there is a loss of the blue field, especially in the area of the detachment, while in the diseases of the optic nerve the red field is either restricted or the color is not seen.

In the neurasthenic patient there is, a

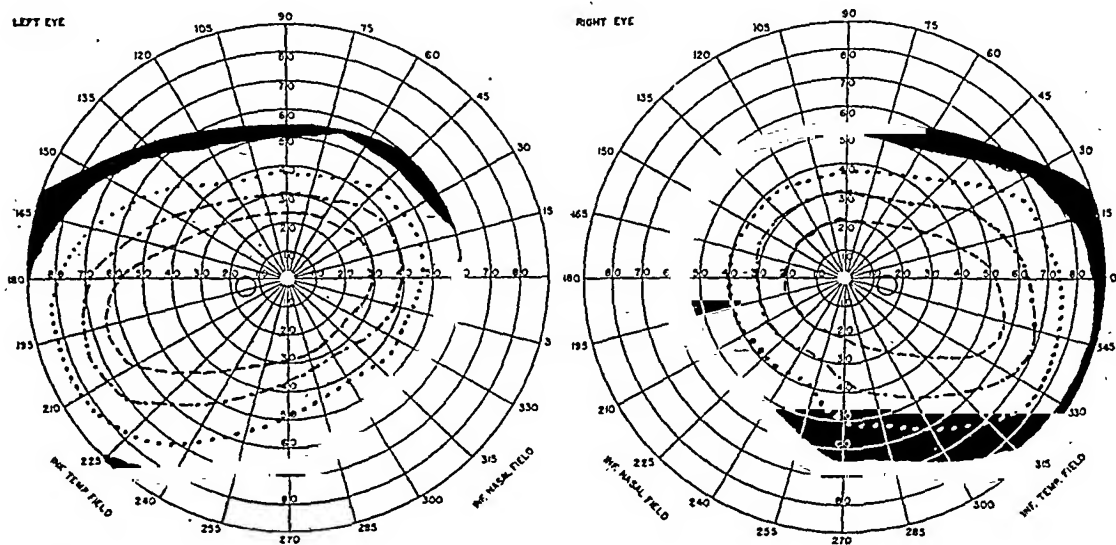


Fig. 1 (Reeder). Normal form and color field. The sizes of targets for the field in the four figures presented are 2/330 for the form, 5/330 for the color fields. Dots = blue; dot dash = red; dash = green.

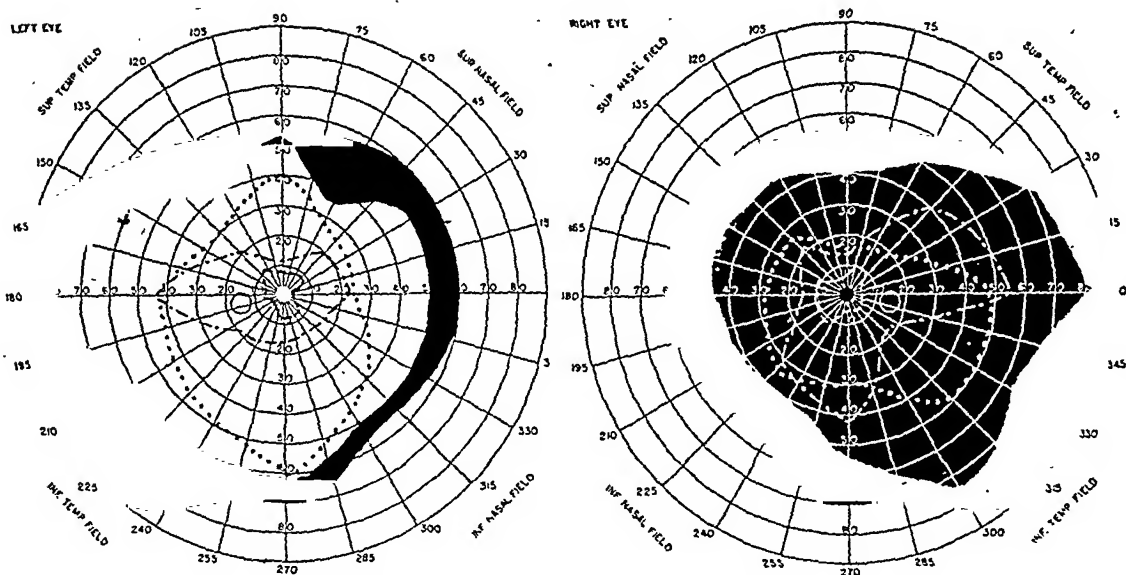


Fig. 2 (Reeder). Psychogenic field, mild.

change in the way the colors are arranged, and also in the size of the field of colors. The normal field for form and color is as shown in figure 1. As one can see, there is a wide range of even monocular vision. A normal color field will show the same contour as the form, except that the blue will extend only to a point about 25 degrees inside the form. The red, which is next in turn, will extend to within 10 degrees of the blue, and the green will ex-

tend to within 10 degrees of the red.

In the abnormal field there is a marked decrease in the size of the form as well as the color. The fields are irregular in shape also, but the most decided change is that of the position of the colors. Instead of being from without in, the colors are interlaced or they may even be inverted. It may so happen that the colors extend outside of the form limits.

In the study at this hospital a series of

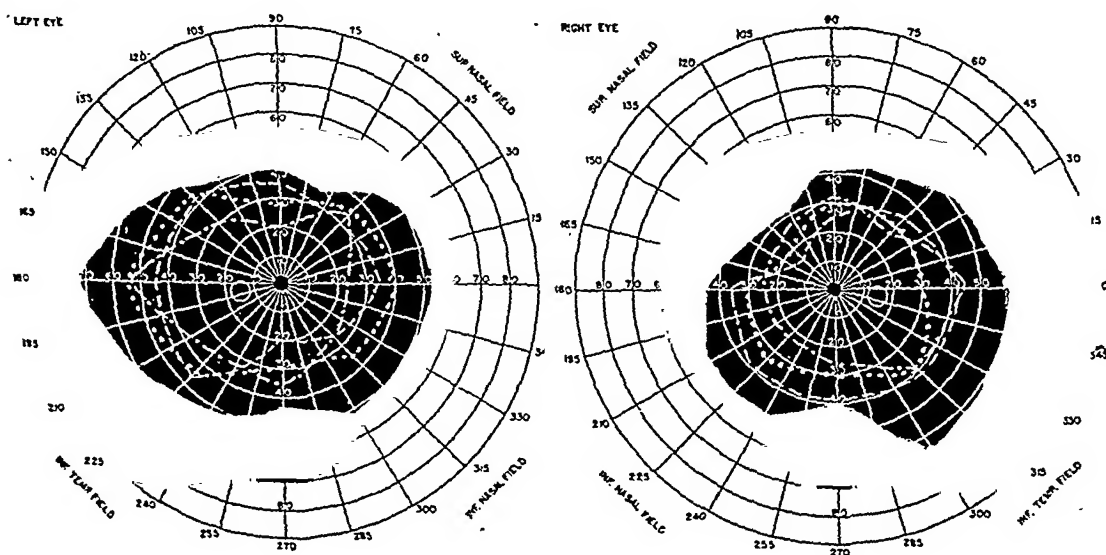


Fig. 3 (Reeder). Psychogenic field, moderate.

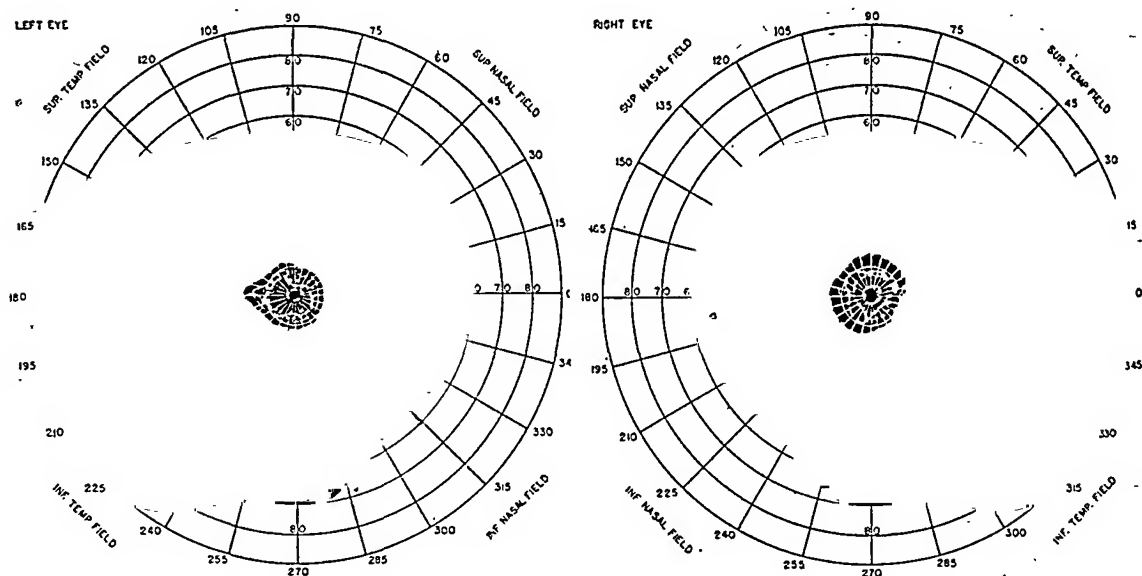


Fig. 4 (Reeder). Psychogenic field, severe. Green is the very small innermost field.

cases was chosen in which there was no evidence of pathology or only a visual error that could be corrected to normal. These cases came from all departments, and had all types of complaints. However, at no time was there any definite change that was pathologic. No other criterion than the one mentioned was used in the selection of the cases. The majority of the patients came from the Neuropsychiatry Service. Twenty-seven were seen in the Eye Department and an additional 19 were sent in by others. All of those from the Neuropsychiatric Service were psychoneurotics who complained of some type of eye symptom from pain to poor vision. It was ruled out that there was any

pathology before the fields were taken. Not all of the cases were as well defined as some, but they all showed some change that was functional. Of the 87 patients examined, 64 exhibited the psychogenic field, which ranged from mild to severe. This is evidenced in figures 2 to 4. Many of the patients presented bizarre symptoms that could not be substantiated by organic pathology. On the other hand, there were those who showed no definite pattern from the psychiatrist's point of view, and the only change that could be demonstrated was that of the functional oberration in the color fields. An illustration of the bizarre symptoms

TABLE 1  
SHOWING THE DISPOSITION OF THE CASES

Source	Number	Mild	Moderate	Severe	Normal	Percent	Disposition	Duty	Cdd
Eye Dept.	27	1	6	11	8	30.2	8	19	
Neuro-Psychiatric Service	41	5	11	23	2	47.6	0	41	
Others	19	1	6	10	2	22.9	7	12	
Totals	87	7	23	44	12				
Percent	100	8.1	26.7	51.1	13.9	100			

was found in a man who came in with the complaint of constant priapism. No organic cause for this was found. Examination of the other systems of the body was made but no pathologic basis was found. Examination in the Eye Department revealed no abnormalities of the visual apparatus, and on questioning the patient unexplainable discrepancies were found in his story. A form and color field were outlined, and a functional change was found. The psychiatrist then examined the patient, and after four or five conferences was able to establish a functional diagnosis. It was believed that the fields in this case were a definite help in giving a lead in a case that was obscure from a psychoneurotic standpoint. The obscurity is due to the fact that some of the patients who come in are unwilling to talk, and the psychiatrist is unable to get a lead. Fields in a case such as this help to give the psychiatrist a point of departure in making his examination.

The table is self-explanatory in that it

shows where the cases originated, and their ultimate disposition.

#### CONCLUSION

It has been demonstrated that the psychogenic color field is of definite aid in the establishment of a psychoneurotic diagnosis. It is tangible evidence in an otherwise abstract diagnosis. It is a test that cannot be faked, therefore malingerers cannot make use of it. As in all things medical no claim is made that this test is infallible, but when the test is positive it is an aid to diagnosis. In this series all of the psychoneurotic patients did have the change in the color fields, from mild to severe. Eighty-seven cases were reviewed; 72 were separated from the service for psychogenic reasons; 19 of the 72 were discovered by their psychogenic type of color field before they had had any association with the neuro-psychiatrist.

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# TUMOR OF THE LACRIMAL GLAND\*

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The lacrimal gland is rarely the site of pathologic processes. The reasons for this are its small size, excellent blood supply, dependent drainage, and protection from traumatic influences. Pathologic swellings of this organ may be considered in four groups: 1. Inflammatory processes. Infection may be an acute suppurative one or one of the forms of bilateral chronic granulomatous hyperplasia, commonly syphilitic or tuberculous. 2. Neoplasms. 3. Cysts or dacryops. These may result from retention of secretion due to obstruction of the lacrimal ducts. 4. Mikulicz's disease. Various forms of this unique syndrome occur in blood dyscrasias particularly leukemia. It also occurs physiologically in weeping and menstruation.<sup>1</sup>

Tumor of the lacrimal gland is usually of the mixed type.<sup>2</sup> Ziporkes<sup>3</sup> stated that "The salivary and lacrimal glands are the seat of mixed tumor and are probably derived from the buccal ectoderm, with possible admixture from the maxillary periosteum or the branchial cartilage. They represent elements in the form of strands of cells, alveoli, diffuse masses of mesoblastic tissue, chiefly cartilaginous, mucous and cellular connective tissue. Any of these may predominate, giving rise to nearly pure chondroma, sarcoma, or carcinoma, but usually all the types of cells are represented." Mixed tumors occur in various forms from highly differentiated types to infiltrative anaplastic carcinoma. They are to be regarded always as potentially malignant. As a rule they are well encapsulated and grossly

firm. When invasive they tend to erode into the cranial cavity through the roof of the orbit. They rarely metastasize but are very prone to recur locally after removal.<sup>1</sup>

## SIGNS AND SYMPTOMS

The first and most constant symptom is proptosis of gradual onset. The eyeball is displaced downward, nasalward, and forward from the socket. Diplopia is exceedingly annoying. The displacement of the images is vertical and is increased when the patient looks toward the side of the lesion. In a few cases the proptosis is extreme. In the case herein reported the eye had repeatedly extruded between the lids, which would fall behind it. This caused such excruciating pain that manual replacement of the lids had to be done under general anesthesia. Vision in the affected eye may be compromised because of traction upon the optic nerve as the eye is slowly and gradually luxated. This diminution in visual acuity may disappear or become much less marked after successful removal of the tumor.<sup>4</sup> Pressure on the posterior portion of the eyeball may indent it, producing the ophthalmoscopic picture of detachment of the choroid.<sup>3</sup> The cornea may be exposed and develop exposure keratitis. The visual field may be normal or show a small central scotoma for form and color.<sup>4</sup> A firm mass is usually palpable in the region of the superior lateral orbital margin under deep pressure of the finger.

## DIFFERENTIAL DIAGNOSIS

Proper classification of these cases compels a consideration of all the causes

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of exophthalmos. Dermoid cyst may be primary in the upper lid and should be considered in all cases in which the proptosis is slight and enlargement of the upper lid is marked. An aneurysm often pulsates, and a bruit may be heard over it. Retro-orbital hemorrhage and abscess are to be considered. One should remember luetic periostitis of the orbit, also soft, fluctuant mucocele extending from the anterior ethmoid or frontal sinus. The rare glioma of the optic nerve is to be seriously considered if there is complete blindness with dilated pupil and marked nerve-head pallor. In cases in which the ocular fundus cannot be seen, the possibility of a retrobulbar extension of a primary intraocular malignancy must be borne in mind. Measures should be taken to rule out systemic conditions producing exophthalmos, particularly Hand-Schüller-Christian's disease and Graves's disease. Careful neurologic examination should be conducted in all cases. Radiologic studies are exceedingly important in the diagnosis, prognosis, and intelligent selection of the route of surgical approach. Roughening, distortion, or asymmetry of the sphenoidal ridges leads to suspicion of orbital extension of an intracranial growth or *vice versa*. Enlargement of the optic foramen usually indicates tumor of the optic nerve. Concentric expansion of the orbital walls betokens a large tumor requiring wide exposure. Radiologic evaluation of paranasal-sinus disease requires the attention of a competent radiologist. Some orbital tumors exhibit calcification, particularly hemangioma and Koch's infections.

#### TREATMENT

The treatment is surgical. Irradiation may be considered an adjunct only. Surgical approach to the lacrimal gland is made by one of three routes. The first of these

is the direct approach through the skin of the upper lid or the conjunctiva of the superior cul-de-sac. This is satisfactory for small tumors but gives poor exposure; where the palpebral portion of the gland shows marked enlargement this may be the method of choice. The second approach is the Krönlein operation which gives excellent exposure by resection of the lateral wall of the orbit as a bone flap. This approach is peculiarly adaptable to lacrimal tumors which are usually laterally situated in the orbit. It gives access to growths above or within the muscle cone. The third method is the cranial approach. This is the most radical but has much in its favor. In cases in which the growth is large, the diagnosis uncertain, under conditions in which it seems highly desirable to save the eye, this method in good hands is excellent. It should always be used, of course, if neurologic signs of brain involvement are present. Because of the pronounced tendency of these tumors to erode the bony roof of the orbit, the removal of this involved bone cannot but decrease the number of recurrences from this cause. It is important to remember, however, that should it seem necessary at any time to exenterate the orbit, such an operation is difficult to perform from above at the time of the craniotomy and hazardous to perform at a later date from below because of the possibility of meningeal infection. It is axiomatic in the treatment of these tumors that it is important to save the eyeball only if all the tumor can be removed.<sup>3, 5</sup>

Most of the cases in the literature have been operated on by the direct approach or the Krönlein approach. Chief among those who champion the cranial approach is Dandy,<sup>6</sup> who believes that all orbital growths should be attacked in his manner. It is his opinion that from 75 to

80 percent of all orbital tumors are also intracranial, that less radical procedures lead to incomplete removal of the tumor. It is needless to say that in cases in which there are obvious malignancy and total blindness with degenerative changes in the globe, total or subtotal exenteration of the orbit is the procedure of choice.

#### CASE REPORT

A white man, aged 45 years, was first seen in the out-patient Eye Clinic on

outer angle of the left orbit and it was thought that the left lacrimal gland was either displaced or enlarged. No crepitus could be detected in the periorbital soft tissues after forcible blowing of the nose. The Zeiss exophthalmometer read 14 mm. for the right eye and 32 mm. for the left. The left upper nasal cavity was almost completely obstructed.

Blood counts and urinalyses were normal. Blood serum cholesterol was 450 and total lipids 1,032. The Kline and

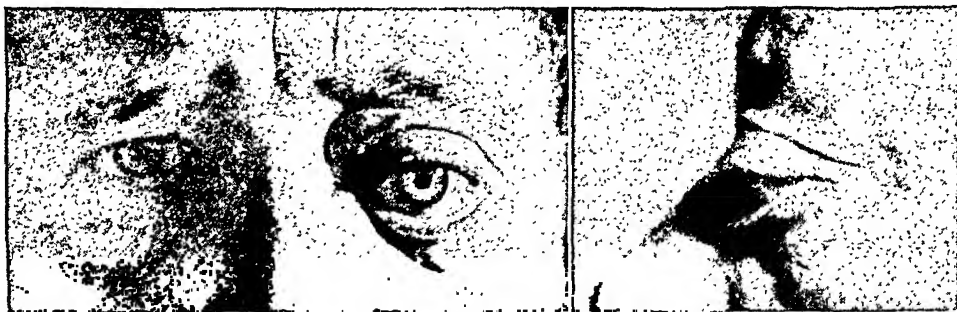


Fig. 1 (Flick). Preoperative photograph showing vertical and axial displacement of the left globe.

August 18, 1941, complaining of a bulging left eyeball. There was a history of a gradually progressing exophthalmos of the left eye for eight years. The patient stated that he had been struck over the left eye with a shovel. There had been several attacks in which the eye had proptosed completely from the socket to be returned manually under anesthesia.

Corrected vision of the right eye was 20/13 and of the left 20/50. There was vertical diplopia increasing on levoversion, indicating relative elevator insufficiency of the left superior-rectus muscle. The left eyeball appeared to be displaced downward. The peripheral field of the left eye was normal with a 5/330 white stimulus, and the fundus examination of both eyes was essentially negative.

A tumor mass was felt at the upper

Mazzini tests upon the blood were negative. Neurologic examination revealed no signs of central-nervous-system involvement.

X-ray examination (fig. 2) revealed an increased density of the intraorbital contents on the left side, giving rise to a clouded appearance of the orbital shadow. There was some slight osteocondensation of the anterior nasal rim of the left orbit. The lacrimal fossa of the left orbit was seen to be enlarged to approximately twice the size of that of the right. There was definite thinning of the floor of the left lacrimal fossa produced by erosion, and the supero-lateral limits of the orbital wall in this region were irregular and partially destroyed. There seemed to be an area of bone destruction extending from the lacrimal fossa on the left side into the floor of the anterior



cranial fossa. The optic foramina were equal and normal in size and shape on the two sides.

On October 23, 1941, a small osteoplastic flap was reflected over the left frontal lobe by Dr. Robert L. Glass. The anterior limb of the flap lay just above the frontal sinus. The dura was elevated from the roof of the left orbit. The roof

detritus was evacuated under pressure. Increased intraorbital pressure had caused erosion of the bony wall of the ethmoid cells, establishing free communication between these cells and the orbit. Examination of a frozen section was reported "probable malignant neoplasm." Complete removal of the growth appeared to be inadvisable. About three-fourths of

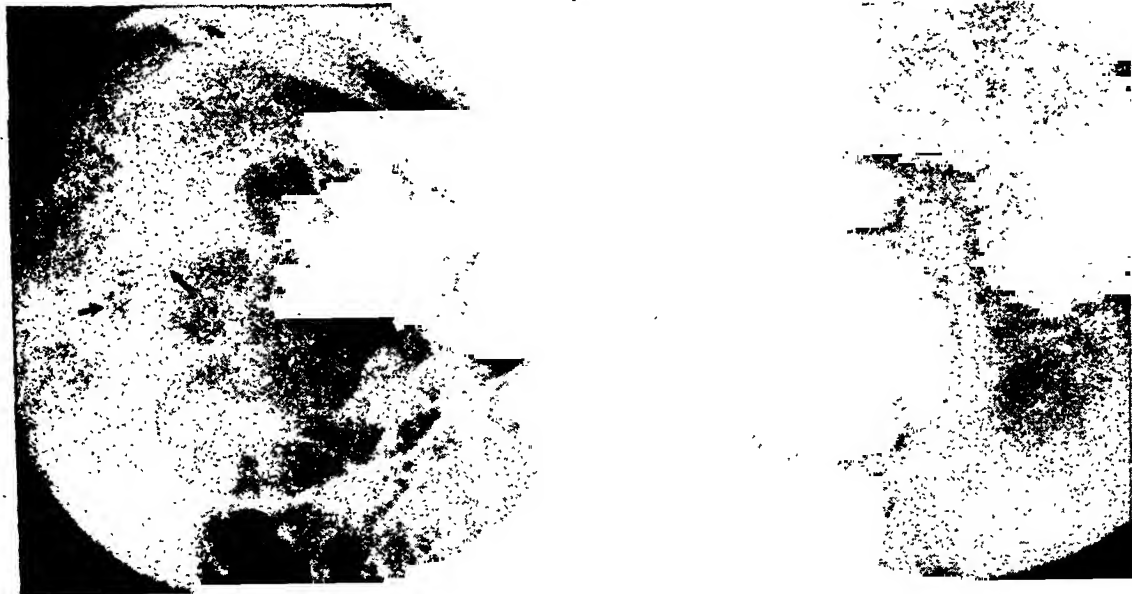


Fig. 2 (Flick). Roentgenograms of the orbits showing the equal and normal optic canals. Arrows indicate bony erosion and destruction in the region of the left lacrimal fossa.

of the orbit was paper thin. Bony erosion was noted in the antero-lateral surface of the orbit, and a small amount of friable tumor was eroding through the bone in this region. The roof of the orbit was partially removed by the use of a rongeur. A large tumor was found in the orbit behind the globe. The tumor lay mostly in the lateral and superior divisions of the orbit and had displaced the eyeball forward and the cone of muscles medially. The tumor appeared to have a thin capsule. It was soft and friable and somewhat grayish in color. On its medial surface was a large cyst. The cyst was incised and a thin fluid containing much

it was removed. The pathologic report of Dr. Frank Forry is as follows:

The section for study is stained with hematoxylin and eosin. It shows numerous small, discrete masses of tumor tissue. These present a varied tissue pattern. In some areas tumor cells form alveolar masses outlined by a very delicate connective-tissue stroma (fig. 2, A).

In some other areas the tumor cells appear as cuboidal cells, lining spaces and thus form an adenomatous pattern. These glandlike structures are evenly spaced and are usually rather widely separated by masses of closely packed tumor cells (fig. 3, A).

In other areas the tumor cells lie in thick rings and masses separated by loose stroma (fig. 3, C). In still others the tumor cells form a loose, fine-meshed reticulum within which lie round, solid masses of cells. The center of such

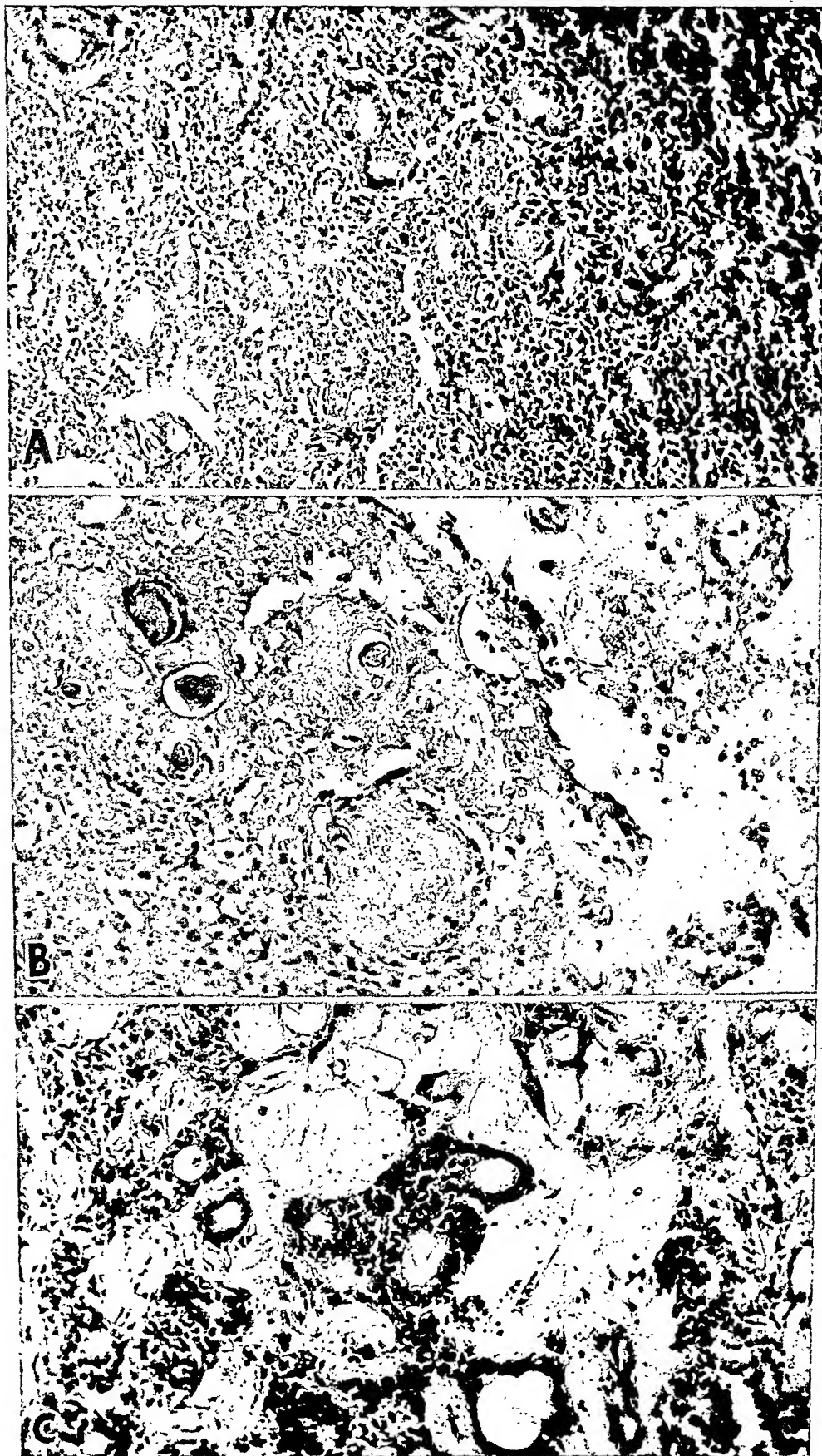


Fig. 3 (Flick). Photomicrograph showing the various tissue patterns found in different areas of the neoplasm.



Fig. 4 (Flick). Postoperative photograph taken on the nineteenth postoperative day showing disappearance of proptosis.

masses tends to become hyaline and laminated. Spinous processes could not be demonstrated in any of these cells (fig. 3, B).

The tumor tissue is well vascularized and in some instances the tumor cells seem to form the blood channels. In most instances, however, there is a well-defined vessel wall surrounded by a zone of loose connective tissue; this, in turn, is sharply delimited by surrounding tumor tissue.

The tumor cells are epithelial in type and show a remarkable pleomorphism. They appear as round, oval, spindle, cuboidal, and stellate cells. The nuclei are round or oval. The nuclear membrane is sharply outlined. The chromatin is

*Diagnosis:* Neoplasm showing the features of adenocarcinoma.

The postoperative course was uneventful. The proptosis and diplopia both disappeared soon after the operation, much to the joy of the patient (fig. 4). He was advised to have a complete exenteration of the left orbit but refused. He was also advised to return for a series of deep X-ray treatments. This he did not do but he returned to the Eye Clinic for a check-up examination and photograph



Fig. 5 (Flick). The patient 18 months after surgery. Note the exaggerated orbito-palpebral sulcus on the left.

present as one or two coarse granules surrounded by fine dust, giving the nucleus a pale blue color. A moderate number of cells show karyokinesis. A pink-staining substance resembling ground substance, present in small amounts, occurs, with the delicate connective tissue stroma supporting the tumor parenchyma.

There are no cartilaginous cells, and lymphoid tissue is not present in this section.

April 28, 1943, at our request (fig. 5). At this time the visual acuity in each eye was 20/15 corrected. The exophthalmometer read 17 for the right eye and 21 for the left. There was a distinct hollow in the left eyelid over the region of the lacrimal gland (see illustration). The pa-

tient made no complaint at this time.

### CONCLUSIONS

1. Tumor of the lacrimal gland is a clinical as well as a pathologic entity.

2. Preoperative diagnosis is possible in a high percentage of cases.

3. The treatment is surgical.

4. A case of tumor of the lacrimal gland is reported.

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## A REPORT ON DEFECTS FOUND IN TONOMETERS EXAMINED AT THE CHECKING STATION OF THE NATIONAL SOCIETY FOR THE PREVENTION OF BLINDNESS

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For several decades the ophthalmologic profession has regarded the Schiötz tonometer as a very useful instrument and necessary to our practice. However, more recently, ophthalmologists have come to realize that the tonometer is not so reliable an instrument as one would wish it to be.

Not only do different tonometers register varying tensions for the same eye, but successive measurements made with the same instrument may vary by as much as 3 to 4 or even more millimeters of mercury\* in either direction, even though the technique is faultless. Consequently, a situation exists in which instruments used for measuring purposes do not measure but confuse; and when one considers

that many ophthalmologists are prone to base their diagnosis of glaucoma mainly on the tonometric readings, the situation becomes quite serious. Errors of technique play an important part in causing inaccurate measurements; equally responsible for unreliability are defects in construction and performance of the tonometer.

The present report on defects discovered from the examination of 68 tonometers of the Schiötz type† supports the statements made in the introductory remarks of this paper. [Since writing this report we have examined 62 more tonometers.]

The specifications for the various con-

\* Slight reduction of tension with successive applications of the tonometer might be ascribed to the massage effect, as pointed out by one of us (Schoenberg. Clinical and experimental research on intraocular drainage. Arch. of Ophth. 1913, v. 42, no. 2.). However, this lowering of tension takes place only after the tonometer has been applied continuously for 10 or more seconds (usually 20" to 30").

† Only tonometers of the Schiötz type were examined because of our familiarity with the specifications for and methods of examining instruments of this type.

stituent parts of the tonometer and for the instrument as a whole, as established originally by Professor Schiötz, were adopted as the standard for the instruments submitted for examination. In the course of time, it was found that several

fects are classified as major and minor.

The major defects are those which concern those parts or units that are essential for the accuracy of performance, and each of these is a source of considerable error. The summation of two or more

Fig. 1 (Schoenberg and Posner). Major and minor defects discovered in tonometers at the checking station\* of the National Society for Prevention of Blindness.

### MAJOR DEFECTS

Weight of plunger, load, lever (hammer and pointer)—too heavy or too light.

Weight of tonometer—too heavy or too light.

Lever ratio— $ab$  to  $bp$ —greater than or less than 1 to 20.

Fulcrum—wobble or looseness.  
Handle—too soft.

Foot plate and foot of plunger—edges sharp or chipped.

Foot or plunger—under surface flat or convex.

Curvature of the upper surface of the testing block.



Testing block

### MINOR DEFECTS

Scale markings—inaccurate; not sharp; no color contrast.

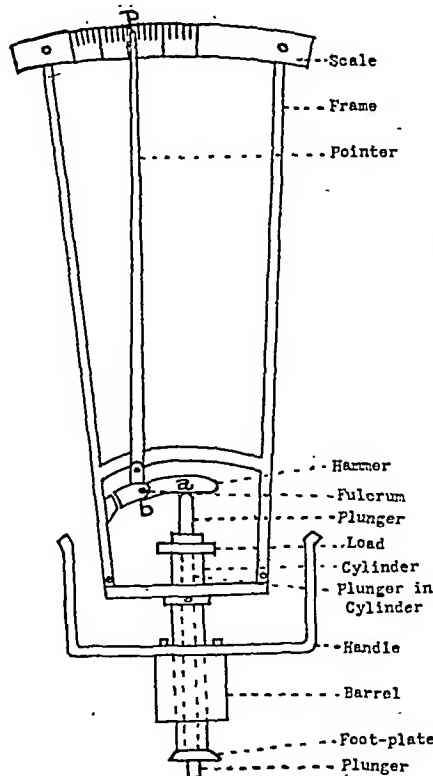
Pointer—out of shape; too far from scale; not equidistant from all points of the scale, too deep, too thick.

Plunger tip—too sharp or too flat.

Plunger in cylinder—presence of friction—too loose or too tight.

Groove of plunger and upper extremity of interior of cylinder—contains foreign matter and sticks.

Foot plate—radius of curvature too large or too small.  
Foot plate—diameter—too large or too small.



\* Under the direction of Mark J. Schoenberg, M.D., and Adolph Posner, M.D.

more specifications and methods had to be added to those used by Schiötz at the Oslo checking station. Thus, at our own station each instrument received was submitted to an examination consisting of 21 separate steps (table 1).

For brevity's sake the data obtained are summarized in figure 1 and table 1. Figure 1 indicates the various places in tonometers where defects in construction and performance were found. The de-

fects may render the instrument utterly unreliable.

The minor defects affect the accuracy of tonometers to a lesser degree, but the summation of several minor defects may constitute a major one.

*Major defects.* 1. The weight of the plunger load lever (hammer and pointer) unit should be 5.5 grams. An increase of one gram causes a reading toward a lower tension of one division or more on

the scale. This error is all the more considerable if the tension in a particular case happens to be in the critical zone\* of the tonometric curve.

2. If the weight of the entire tonometer exceeds the specification of 16.5 gm. by several grams, it will be the source of a serious error in measurement.

3. The lever ratio, the ratio between the length of the short arm  $ab$  (4 mm.) and that of the long arm  $bP$  (80 mm.) should be 1:20. The upper extremity of the pointer ( $P$ ) moves to the right 20 mm. (from 0 to 20). Thus, for each pointer deflection of one division on the scale (there are 20 divisions), the plunger makes a depression in the cornea of 0.05 of one millimeter. Any minute deviation from the ratio of 1:20 may be a source of a considerable error in the registration of the tension.

4. If the point of rotation of the lever (the joint between hammer and pointer) at the fulcrum is not stable (loose) or if the lever itself does not fit properly at that point on the fulcrum, a wobble develops during the excursion of the pointer along the tonometer scale. The pointer will then not always stop precisely at the same line, when the tonometer is applied several times in succession to the same eye, but will perform an oblique torsional movement causing a reading error of one or more divisions. This is frequently the cause of inconsistent registration on the scale.

5. If the handle is too soft, it may be pressed against the frame when placed on the eye. Hence, this pressure on the eyeball will register artificial hypertension.

6. If the radius of curvature of the testing block is greater or less than 16 mm., it does not match the curvature of the footplate, and the advantage of check-

ing the tonometer for the zero point is lost.

7. If the edges and under surfaces of the foot plate and foot of plunger are rough, sharp, or chipped, a corneal abrasion may follow the application of the tonometer.

8. A convex undersurface of the foot of the plunger will cause an error (reading toward lower tension) by several divisions on the scale; a flat undersurface of the plunger will cause an error (toward lower tension) of about one division on the scale.

*Minor defects.* 1. If the scale markings are not sharp, or do not contrast adequately with the white background of the scale plate, one may experience some difficulty in reading them.

2. If the upper extremity of the pointer is too far in front of the scale, an error in reading will result due to the parallax displacement; if the pointer is too close to the scale it may scrape against it; if too broad it will cover the dividing lines or the space between them and will interfere with correct reading.

3. If the tip of the plunger is too sharp or too flat, it is liable to produce either a deep depression or a long groove on the undersurface of the hammer, and friction will result.

4. If the diameter of the plunger is too large or too small, it will fit either too snugly or too loosely in the cylinder, respectively, and cause friction. In either case an error in registering the tension will occur.

5. If the interior of the cylinder and the surface of the plunger lack smoothness or are sticky from the presence of foreign matter the friction is increased beyond the tolerance point.

6. If too large or too small, the radius

\* The critical zone on the tonometer scale is that portion which registers the borderline between "normal" and "high." Obviously, to the clinician, this is the most important part of the scale.

TABLE 1

REPORT ON 68 TONOMETERS EXAMINED AT THE CHECKING STATION\* OF THE  
NATIONAL SOCIETY FOR THE PREVENTION OF BLINDNESS

Items Checked	Specifications, Standard with Tolerances	No. of Tonom- eters within Standard	Defective Tonometers					Total Tonom- eters Checked <sup>a</sup>
			Greater than	No.	Less than	No.	Total no.	
1. Weight of tonometer	16.5 gr. $\pm$ .5	45	17. gr.	7	16. gr.	12	19	64
2. Weight of plunger plus hammer, pointer, and load	5.5 gr. $\pm$ .25	13	5.75 gr.	48	5.25 gr.	4	52	65
3. Weight of load 7.5	2. gr. $\pm$ .05	45	2.05 gr.	8	1.95 gr.	10	18	63
4. Weight of load 10	4.5 gr. $\pm$ .05	44	4.55 gr.	6	4.45 gr.	14	20	64
5. Diameter of foot plate	10.1 mm. $\pm$ .1	17	10.2 mm.	12	10. mm.	38	50	67
6. Diameter of plunger	3. mm. $\pm$ .05	47	3.05 mm.	5	2.95 mm.	15	20	67
7. Radius of curvature of foot plate	15. mm. $\pm$ .5	49	15.5 mm.	7	14.5 mm.	11	18	67
8. Radius of curvature of testing block	16. mm. $\pm$ 0	13	16. mm.	12	16. mm.	41	53	66
9. Reading on 15 mm. disc	-1. mm. $\pm$ 0	17	-1. mm.	37	-1. mm.	13	50	67
10. Reading on 16 mm. block	0 $\pm$ 0	10	0	43	0	14	57	67
11. Reading on own block	0 $\pm$ 0	53	0	5	0	8	13	66
12. Lever ratio	1 to 20 $\pm$ 0	26	1 to 20 <sup>b</sup>	29	1 to 20 <sup>c</sup>	12	41	67
13. Radius of curvature of foot of plunger	concave	53	flat	11	convex	3	14	67

\* Impossible to check all items on total of 68 tonometers because of missing weights and test blocks in the set, of handles, and instruments out of alignment.

<sup>b</sup> Higher ratio indicates reading is too soft.

<sup>c</sup> Lower ratio indicates reading is too hard.

Additional items recently added to the procedure of checking:

14. Condition of division lines on scale (blurred, too thick)
15. Distance of pointer from scale (too far, too close)
16. Shape of pointer (bent, too broad or thick)
17. Presence of friction between plunger and cylinder

18. Condition of lever (wobble)
19. Condition of plunger (loose, edge chipped or sharp)
20. Condition of foot plate (edge chipped or sharp)
21. Condition of groove of plunger and interior of cylinder (presence of foreign matter)

\* Under the direction of Adolph Posner, M.D., and Mark J. Schoenberg, M.D.

These specifications have been adopted by the Committee on Standardization (Dr. Jonas Friedenwald, chairman) with some slight modification. A paper on the subject will be published in the near future.

of curvature of the foot plate will impair the correct adjustment on the testing block.

7. The diameter of the foot plate, if too large or too small, will cause inaccurate reading because it changes the weight resting on the unit area of the cornea.

*Remarks.* The first two columns in this table present the lists of the items to be checked in tonometers and the standard Schiötz specification for each item. The remaining columns give the number of tonometers in which each of the specifications was found to be correct or defective.

The discovery of the same defects in a large percentage of the tonometers ex-

amined to date leads us to believe that these instruments are fairly representative of the general run of defective tonometers. These instruments were sent to the New York checking station by ophthalmologists in 17 different states\* and Canada.

A glance at the table reveals the following figures regarding a few of the major defects found in the group of tonometers examined:

1. The weight of plunger, load, and lever is either too high or too low in 52 out of 65 tonometers (80 percent).

2. The weight of the entire tonometer is not according to standard in 19 out of 64 (29 percent).

3. The radius of curvature of the test-

\* The following is the list of the states from which tonometers were sent to the New York checking station: California, Connecticut, Georgia, Illinois, Indiana, Kentucky, Louisiana, Massachusetts, Michigan, Minnesota, Nebraska, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Utah.



ing block is not according to the standard in 53 out of 66 (80 percent).

4. The lever ratio is defective in 41 out of 67 (61 percent).

### CONCLUSIONS

The following conclusions seem incapable:

1. A large percentage of tonometers (Schiötz type<sup>†</sup>) contains defects of construction and of performance. These defects point to one of the two reasons for the unreliability of many tonometers.<sup>‡</sup>

2. Every tonometer already in use should be checked at a reliable checking station at the earliest possible time.

3. Inaccurate tonometers should not

be used until the important defects are corrected or adjusted.

4. It is urgent that a number of reliable checking stations be established under the direction of ophthalmologists in appropriate locations, throughout this country.

5. It is important that precision mechanics be found who are able to put defective tonometers in good working order.

6. Manufacturers of tonometers should be urged to have their instruments checked and certified at reliable checking stations before placing them on the market.

*667 Madison Avenue.*

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<sup>†</sup> No one knows how many of the other types are defective.

<sup>‡</sup> The other reason is defective technique of tonometry.

# OPTIC-NERVE ATROPHY IN MALIGNANT NASOPHARYNGEAL TUMORS

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Malignant nasopharyngeal tumors are of interest to the ophthalmologist because of the involvement of the ocular nerves. Involvement of the optic nerve is of special interest because of its infrequent occurrence.

The pathologic study made on the second of the two cases here reported has clarified and opened the way to a better understanding of the first case, which has not come to autopsy.

## CASE REPORTS

*Case 1.* T. R., 30 years old, a white housewife, was referred to the Eye Clinic of the University of Illinois Research Hospital by the Ear, Nose, and Throat Clinic on July 23, 1941, because of a paresis of the right external-rectus muscle and right optic-nerve atrophy. She stated that about a year before she had consulted a physician because of a sore throat and sinus infection; she also complained then of a headache on the right side which began at the bridge of the nose and radiated to the right temporal region. A few months later she developed a diplopia.

The Ear, Nose and Throat Department's report was as follows: "The septum was pushed to the left, showing a pinkish tumor in the epipharynx with an irregular surface resembling adenoids. Hearing was diminished on the right side. X-ray study showed an increased density over the sphenoid sinus (fig. 1), and the sellar outlines were blurred. A biopsy specimen from the epipharyngeal tumor, removed on August 1, 1941, revealed a transitional-cell carcinoma.

The Wassermann test was negative.

Blood count: Red blood corpuscles 3,500,000; white blood corpuscles 6,500; hemoglobin 65 percent. The neurologic examination on August 9, 1941, showed a paresis of the right sixth nerve and hypalgesia of the right side of the face.

Examination of the eyes on August 12, 1941, showed vision R.E. was 5/200;

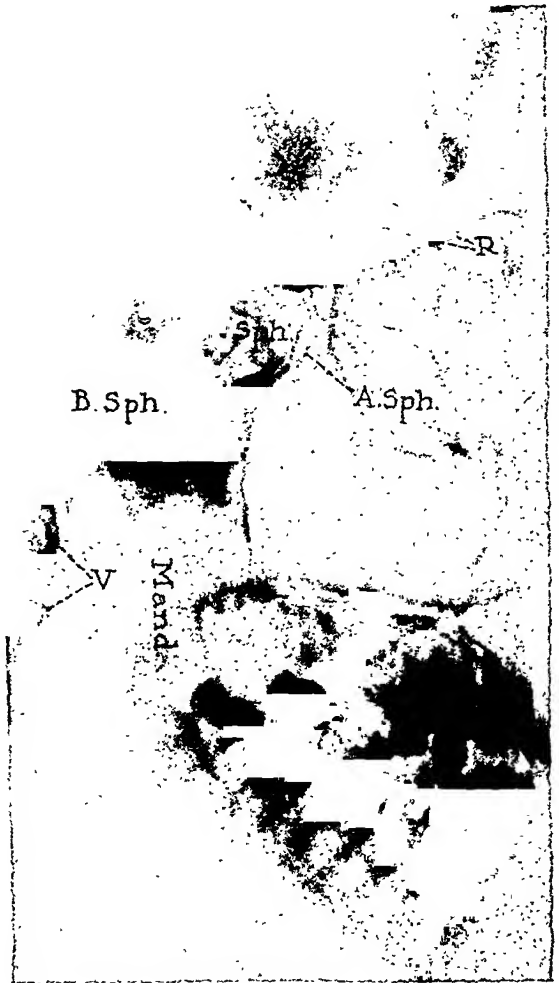


Fig. 1 (Folk). X-ray study of case 1. Sph., sphenoid cloudy due to tumor invasion. Note the absence of tumor within the epipharynx. R, roof of the orbit; S, sella turcica; B.Sph., body of sphenoid; V, vertebrae; Mand., mandible; A.Sph., anterior wall of sphenoid.



Fig. 2 (Folk). Case 2. F.C., falx cerebri calcified; C.G., crista galli; E, ethmoid; S, nasal septum; D.N., diastasis between the two alveolar processes of maxilla.

L.E. 20/20. There was a slight ptosis of the right lid. Some esotropia for distance and esophoria for near was present. There was a weakness of the right external-rectus muscle. The candle-light test showed a homonymous diplopia which increased when the eyes turned to the right. The irides were brown. The pupil of the right eye did not react to direct light but did react consensually. The pupil of the left eye reacted normally. The disc of the right eye was pale, its margins were clearly outlined, and the blood vessels slightly narrowed. The rest of the fundus was normal. The visual field of this eye showed a concentric contraction of 20 degrees and a complete loss of red and green fields. The intraocular pressure was normal.

Patient was given 10,000 r in 40 sessions. Under this treatment the growth disappeared from the nasopharynx. The eyes became parallel and there was some improvement of vision in the right eye from 5/200 to 20/200. However, the neuralgia of the right side, the headache, and the wasting of the body continued.

*Case 2.* C. P., five years old, a white girl, had been a full-term baby, well except for measles in April, 1940, and occasional colds. In December, 1941, she developed a stuffiness of the nose. A physician was consulted, and he found a growth in the nose which he considered to be nasal polyps. He tried to remove them by applying trichloroacetic acid. The child immediately lost consciousness for



Fig. 3 (Folk). Case 2. D, enlarged diploic veins; S, sella turcica; T, tumor; A.Sph., anterior wall of sphenoid; R, roof of orbit; Mand., mandible.

45 minutes. That evening the girl's right cheek and upper lid began to swell and her eyes to water. Shortly after this she began to complain of dimness of vision. According to the history reported by the parents, the swelling of the lids receded but the vision became progressively worse. The child grew exceedingly apprehensive and irritable. She began to have

great difficulty in breathing. Because of the apparently complete obstruction of the nose a rhinologist decided to remove the growth, but immediately after receiving the anesthetic the child stopped breathing and was revived with difficulty. No surgery was performed. About three days after this the right lid began to droop, both eyes teared and began to

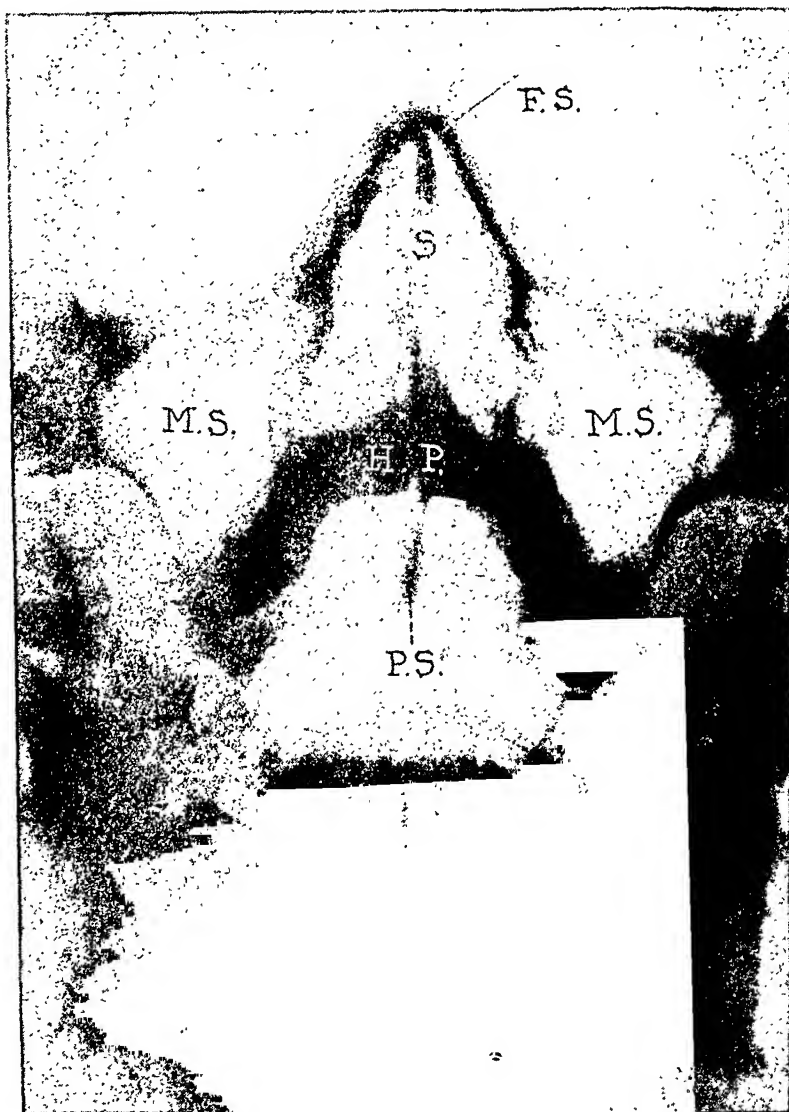


Fig. 4 (Folk). Case 2. F.S., frontal sinus; S, nasal septum; M.S., maxillary sinus; H.P., hard palate; Note the cloudy structure in the area of the posterior ethmoid and sphenoid due to invasion of tumor.

bulge. Her vision decreased to the point where the child could not recognize her parents, and her fearfulness increased.

On admission to the Pediatric Department of the University of Illinois on March 9, 1942, the child was extremely apprehensive and kept her eyes closed as if she had photophobia. In the nose, a tumor extended into the epipharynx and pushed the nasal septum to the right side. X-ray studies showed an increased density over both maxillary sinuses and some of the left ethmoid cells (figs. 2 and 4). There was a complete absence of intranasal bony structure. The blood chan-

nels over the anterior part of her skull were unusually prominent and the intermaxillary suture was open (fig. 3).

The eye findings on March 10th revealed a moderate proptosis of the right eye and slight proptosis of the left eye. Vision could not be taken because of poor coöperation. There was a mild suppurative dacryocystitis on the right side. The pupils were 6 mm. in diameter and reacted poorly to light, but the eyegrounds appeared normal.

On March 17th, the proptosis on the left side was marked. Both pupils were dilated to 6 mm. and neither reacted to

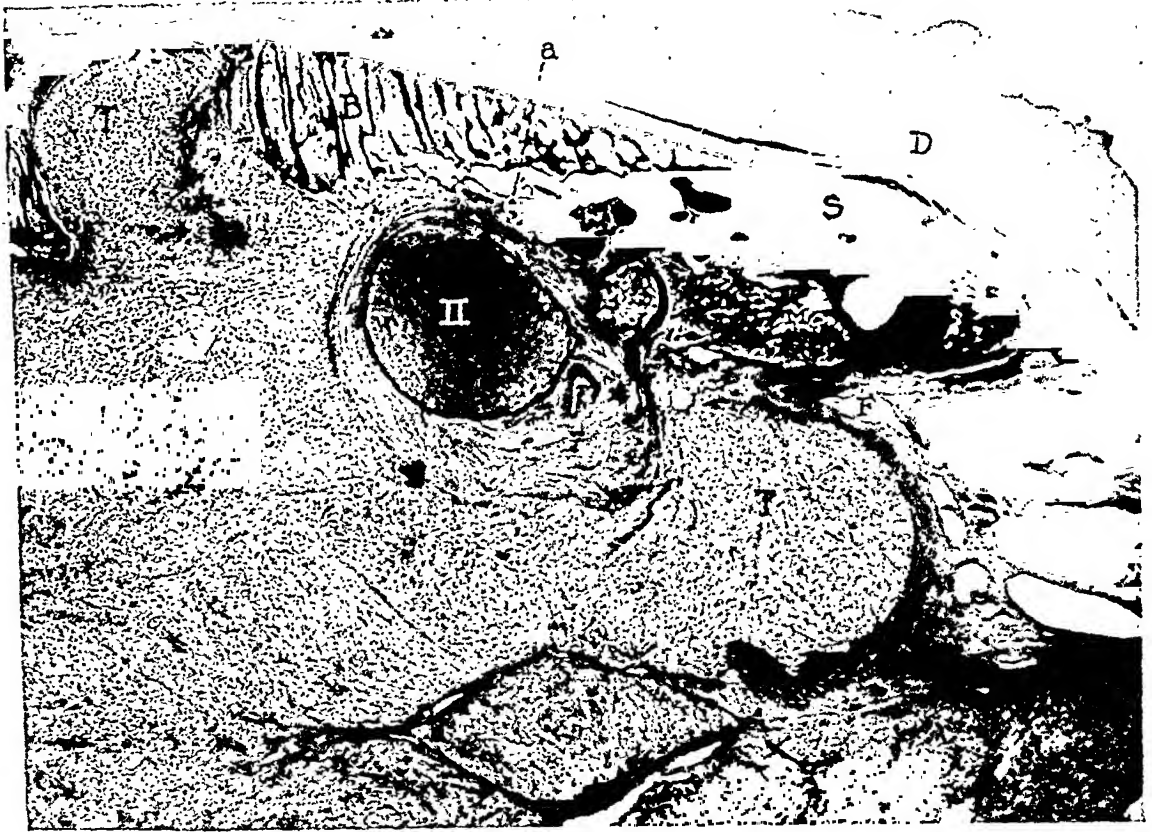


Fig. 5 (Folk). Case 2. Frontal section through the sphenoid field within tumor masses. T, tumor; II, optic nerve; F, superior orbital fissure; B, newly formed bone; S, small wing of sphenoid; D, dura; a, indicates an erosion of the small wing of sphenoid.

light. There were a complete external ophthalmoplegia, and a ptosis on the right side; the palpebral fissure was narrowed to a slit and apparently there was complete blindness. Wassermann and Kahn tests were negative.

On March 25th the child died.

The autopsy revealed a proptosis of both eyes. The nasal septum was deviated to the right. The calvarium was thin and on its inner aspect near the vertex there were two rounded-out depressions. The dura was elevated uniformly throughout the region of the cribiform plate, the planum sphenoidale, and the region of the sella turcica. The dura was not perforated. All of the paranasal sinuses were obliterated by a white, boggy tumor mass which had destroyed the bone and cartilage but was limited by the mucous

membrane lining the sinuses. The lacrimal bone on the right side was partially preserved (fig. 3).

#### MICROSCOPIC EXAMINATION

*Palate:* The tumor was extremely cellular, containing for the most part spindle cells. It was separated from the glandular layer on the oral surface of the soft palate. The bone of the hard palate was separated from the tumor but showed marked osteosclerosis and less-marked osteogenesis due to pressure of the new growth.

*Hypophysis:* The largest part of the section consisted of a tumor mass which replaced the entire body of the sphenoid and reached the dura in the region of the anterior clinoid process but did not perforate the dura at any place. In the

region of the posterior clinoid process the tumor was distinctly separated from the very active red marrow of the clinoid process. The synchondrosis sphenooccipitalis was reduced to a very narrow layer of cartilage which was eroded but not perforated by the tumor. The hypophysis was pressed against the posterior clinoid process. The new growth

consisted of atrophic trabecula which were lying fairly parallel and extended toward the internal layer of the dura in a right or acute angle. There was loose connective tissue between these trabecula but the connective tissues did not present infiltration. In other places the tumor perforated the outer layer of the dura and the newly formed bone reached the inner



Fig. 6 (Folk). Case 2. Weigert stain of optic nerve.

consisted of pleomorphic cells and many giant cells. Spindle cells were also seen but in fewer numbers. The diagnosis of the tumor was *spindle-cell sarcoma*.

*Optic nerve:* The tumor contained parts of the intersphenoidal synchondrosis and remnants of the mucous membrane of the sphenoid. Toward the dura the tumor was covered with various tissues. In the area of the planum sphenoidale the dura was markedly thickened and between the layers of the dura a layer of new bone was formed (fig. 5). The new bone con-

sisted of atrophic trabecula which were lying fairly parallel and extended toward the internal layer of the dura in a right or acute angle. There was loose connective tissue between these trabecula but the connective tissues did not present infiltration. In other places the tumor perforated the outer layer of the dura and the newly formed bone reached the inner

sheath of the dura, which was not perforated at any place. Laterally, the tumor surrounded the optic nerves but in no place did it perforate the dural sheath (fig. 6). The ophthalmic arteries on both sides were normal. While the tumor did not perforate the periosteum, it apparently pressed the optic nerve toward the lesser wing of the sphenoid which separated the optic canal from the superior orbital fissure, the lesser wing of the sphenoid being thereby destroyed in that area of



pressure. The tumor advanced toward the superior orbital fissure but did not penetrate the periosteum of the orbit.

#### COMMENT

In case 1, the typical clinical picture of a carcinoma of the epipharynx was presented. Inasmuch as the symptoma-

sphenoid toward the optic canal and involve the opticus in that way.

In case 2 it is shown that the optic nerve might be involved in another manner. Here a very malignant sarcoma invaded both sphenoid sinuses and after destroying the lateral wall of these sinuses penetrated the optic canal so that the

TABLE 1  
NERVES AFFECTED IN CASES OF NASOPHARYNGEAL TUMOR

Author	No. of Cases	Cranial Nerves				
		II	III	IV	V	VI
Oppikofer <sup>1</sup>	21	1	1	2	17	4
Schlieve Kaufman <sup>2</sup>	38	1	2	2	12	8
Woltman <sup>3</sup>	25	5	4	4	2	18
Hansel <sup>4</sup>	9	3	4		4	6
Brunner <sup>5</sup>	15	2	4	1	9	5
Totals	108	12	15	9	44	41

tology and pathology of these cases are very well known, an exhaustive discussion of the laryngologic and neurologic background of the cases is omitted. Attention is called, however, to the optic atrophy in the case, for a study of the literature proves that optic atrophy is not frequently encountered in cases of malignancies of the epipharynx.

The figures in table 1 are only approximations. This is due to the fact that (1) not all cases were observed for a sufficient length of time for them to acquire symptoms of disease of the optic nerve and other eye-muscle nerves which appear in the late stages of the disease, and (2) only certain types of tumors have a tendency to destroy bones and involve the ocular nerves.

The question arises as to how the involvement of the optic nerve can be explained in cases of epipharyngeal malignancies. Several years ago Jacob<sup>6</sup> pointed out that epipharyngeal tumors may grow along the eustachian tube into the skull and advance along the great wing of the

optic nerve was almost completely surrounded by tumor tissue. The tumor then advanced toward the superior orbital fissure. It is interesting to note that the periosteum of the orbit was not perforated by the tumor so that neither the contents of the orbit nor the contents of the superior orbital fissure were infiltrated by tumor tissue. The periosteum of the orbit was pushed forward, inducing the proptosis observed in this case.

Most interesting are the findings concerning the optic nerve. As already mentioned, it was almost entirely surrounded by tumor tissue. Only the roof of the optic canal, which belongs to the anterior fossa of the skull, was still present, although pathologically changed. It should be pointed out that neither the dural sheath of the optic nerve nor the dura of the anterior cranial fossa was perforated at any place; hence there was no sarcomatous infiltration within the optic nerve.

The microscopic findings showed that the optic nerve in this case could be

easily damaged by pressure of the tumor toward the roof of the optic canal and not by sarcomatous infiltration, if the nerve were to be impaired at all.

Whether or not the optic nerve in case 2 was functioning, cannot be definitely stated. I can only report that the nerve when stained with Weigert's solution, which stains the myelin sheath but not the axis cylinders of the nerves, presented normal myelin sheaths. However, this observation must be carefully evaluated because the child died shortly after the onset of symptoms. It is possible that in spite of what was indicated by Weigert's technique, the osmium technique of Marchi would have indicated a degeneration of the myelin sheath. Unfortunately, neither the method of Marchi nor the silver method for impregnation of the axis cylinders could be employed as the condition of the specimen did not permit it. It is, therefore, not possible to state that the optic nerve was entirely normal.

At any rate, case 2 proves that the optic nerve might be involved by perforation of the lateral wall of the sphenoid sinus by a malignant tumor within the

sphenoid sinus. As case 1 presents a definite involvement of the sphenoid sinus, proved by the X-ray picture, it is obvious that the optic atrophy in this case can be explained as due to the same conditions that obtained in case 2, as revealed by the microscopic findings.

### CONCLUSIONS

1. Involvement of the optic nerve in malignant tumors of the epipharynx is not frequent.

2. The optic atrophy in the cases herein described is preceded by invasion of the epipharyngeal tumor into the sphenoid sinus. This fact explains why the appearance of the optic atrophy is late.

3. From the sphenoid sinus the malignant tumor may invade the optic nerve after perforating the lateral wall of the sphenoid sinus.

4. The dural sheath of the optic nerve as well as the periosteum of the orbit and the dura is more resistant to aggression by the tumor than is bone tissue. This holds true for sarcoma.

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## HYPERPYREXIA IN THE TREATMENT OF ACUTE OCULAR INFLAMMATIONS\*

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The treatment of acute inflammatory diseases of the eye has resolved itself into three phases: 1. Standard ophthalmologic management, including local therapy and chemotherapy. 2. The location and elimination of infectious foci. 3. Pyretotherapy, which usually consists in giving the patient frequent injections of some pyretogenic agent, usually a foreign protein (typhoid vaccine or sterile milk). In most cases the mild febrile response obtained, usually less than 104 degrees and of short duration, is insufficient to give any material benefit in severe cases. Only a few patients are given the benefit of the intensive and prolonged therapeutic fever that is obtained with the hypertherm.

The usefulness of the more intensive pyretotherapy cannot be overestimated. It is the belief of the writers that much visual loss could be prevented, and much intense suffering rapidly alleviated, by vigorous application of this type of treatment. It is far more generally available than is commonly realized, since most clinical centers possess some type of fever cabinet employing either the Kettering or a similar principle.

A group of 51 cases of *nonsyphilitic* inflammatory diseases of the eye has been reviewed to demonstrate the striking effectiveness of this method of treatment. These were all cases of severe inflammatory diseases, the prognosis of which was grave had the treatment been confined to routine measures only. In most of these cases foreign-protein-shock therapy and thorough local therapy had previously been used without arrest of

the progress of the disease. Some of the cases were referred to the Department of Fever Therapy by the Department of Ophthalmology of this hospital, the rest were sent by prominent ophthalmologists of this city. It is recognized that many of the patients would have recovered partial vision eventually under other forms of treatment, but the rapid relief of pain and the dramatic speed of recovery with the hypertherm suggest that an appreciable percentage of vision was saved in these patients, many of whom were restored to perfect vision.

Treatments were all given in fever cabinets which use the Kettering principle of hyperpyrexia. The lower level of therapeutic fever is considered to be 104°F., and most treatments are maintained above that level for five hours. The exact level of temperature used depends upon the condition to be treated and the physical condition of the patient. Almost all patients are able to take a five-hour treatment at 105 degrees, which is the usual level for eye conditions. Gonococcal infections require a temperature of 106-107°F., with longer treatments preferred, and the concurrent use of sulfathiazole is suggested.

Treatments are given at intervals of three to five days for as long as is deemed necessary. When these treatments were first used in ocular diseases, we were happy to get relief of pain and arrest of the progress of the disease in the eye. It was felt that the matter of plastic exudates, vitreous opacities, posterior synechiae and such conditions were in the hands of the ophthalmologists. It became evident, as earlier cases were reviewed, that those patients who had more treat-

\*From the United States Public Health Service.

ment had less residual damage, even though they had been apparently hopeless at the beginning. Now treatments are continued, unless the patient's physical condition prevents it, until all improvement has stopped. This is an important observation. It must not be construed as meaning that cases with old, long-standing opacities of the vitreous, old posterior synechiae, or old severe conjunctival scarring will benefit from any amount of

cases listed as having "*excellent results*" there was practically no loss of vision. In cases listed as "*satisfactory results*" there was marked symptomatic improvement but some residual visual impairment; in those listed as "*improved*" there was arrest of the progress of the disease and relief of the acute symptoms but no visual improvement. Cases listed as "*failures*" resulted in no symptomatic relief or visual improvement. In cases listed as "*re-*

TABLE 1  
DISEASES TREATED BY PYRETOTHERAPY AND RESULTS

Diagnosis	No. Cases Treated	Results of Treatment				
		Excell.	Satis.	Improv.	Fail.	Relapse
Herpes zoster ophthalmicus	4	4	—	—	—	—
Neuromyelitis optica	1	—	1	—	—	—
Iritis, acute	9	5	3	—	1	—
Sympathetic ophthalmia	1	1	—	—	—	1
Panophthalmitis	2	—	—	1	1	—
Retinitis, chronic	2	—	1	—	1	—
Corneal ulcer	7	4	1	1	—	1
Foreign body or trauma	3	—	—	2	1	—
Optic neuritis	2	—	1	1	—	—
Iridocyclitis	4	4	—	—	—	—
Ulcerative keratitis	2	2	—	—	—	—
Traumatic keratitis	2	—	—	—	—	2
Acute exudative choroiditis	6	2	3	—	1	—
Interstitial keratitis (nonspecific)	1	1	—	—	—	—
Gonococcal infections:						
(a) Acute conjunctivitis & corneal ulcer	4	—	2	2	—	—
(b) Ophthalmia & iritis	2	2	—	—	—	—
Total	52	25	12	7	5	4

fever therapy. It is only when such conditions are in process of formation and are still plastic that absorption can be obtained. The logical conclusion from this is that the more severe inflammatory conditions of the eye should be treated in the hypertherm at the very beginning of therapy. Early recognition of those cases requiring hypertherm treatment depends upon the alertness of the attending ophthalmologist and his understanding of the value of this treatment in these cases.

Table 1 lists by diagnosis the diseases treated in this series of cases, showing the results of treatment in each group. In

*lapses*" there was variable early improvement which did not persist.

There is a total of 37 patients in whom there were excellent and satisfactory results and whose vision has been restored to normal limits. These may be considered as cured by the treatment. The duration of the disease before the inauguration of fever therapy and the number of treatments given are the two factors which seem to govern the difference between excellent and satisfactory results. It is gratifying to realize that a large proportion of these patients would have been partially or totally blind in the absence of pyreto-

TABLE 2

DATA ON 10 CASES OF OCULAR INFLAMMATION TREATED WITH PYRETHERAPY

Patient	Diagnosis	Initial Vision		Signs in Eye								No. of days previous treatment	Fever Treatments			Results		Final Vision		Remarks		
		Left	Right	Conjunctivitis	Corneal Ulcer	Cornea Perforated	Aqueous Flare	Hypopyon	Synechiae	Vitreous Opacity	Edema—Nerve Head		Retinitis	Keratitis	Pain	No. of treatments	Total hours	Temperature range	Relief of pain		Clearing of signs	Left
M.M.	Keratitis, interstitial (nonspecific)	L.P.	L.P.	2+	0	0	4+	2+	1+	0	0	0	3+	3+	16	80	104-106	Prompt, total	Began after 5th Rx.	20/50	20/40	Free of symptoms for 1 year; now corrects to 20/20 both eyes.
A.E.	Choroiditis, acute, exudative	5/200	20/20	0	0	0	1+	0	2+	2+	0	0	0	3+	5	25	104-106	Prompt, total	Rapid	20/20	20/20	Check after 2 years showed vision same. This patient had no results from routine treatment
J.P.	Iritis, acute left	0	20/20	3+	0	0	1+	0	2+	2+	0	0	0	4+	5	29	105-106	Prompt, total	Rapid	20/60	20/20	Few vitreous opacities remain
M.H.	Ulcerative keratitis, left	20/200	20/20	4+	2+	0	2+	0	0	0	0	0	0	3+	3	15	104-105	Prompt, total	Rapid	20/60	20/20	Should have had more treatment
R.C.	Neuro-myelitis optica	L.P.	8/200	0	0	0	0	0	0	0	3+	0	0	4+	8	38	105-106	Prompt, total	Rapid	20/130	20/120	Corrects to L=20/50; R=20/50. Unchanged in 8 months
F.Y.	Herpes zoster	20/20	Slight haze	2+	2+	0	0	0	0	0	0	0	0	4+	3	15	105-106	Prompt, total	Healing after 3rd Rx	20/20	20/20	Severe supraorbital herpes with corneal ulceration
B.C.	Iridocyclitis, bilateral	20/200	20/120	3+	0	0	1+	0	2+	3+	0	0	0	4+	4	20	104-105	Prompt, total	Rapid	20/60	20/50	Corrected to 20/40 both eyes. Severe dental infection was probable focus
C.L.	Gonorrheal ophthalmia, bilateral	L.P.	L.P.	4+	1+	0	2+	0	1+	0	0	0	0	3+	9	45	106-107	Gradual, total	Rapid after 4th Rx	20/20	20/20	Sulfathiazol not used—(results are better with addition of sulfathiazol)
R.F.P.	Corneal ulcer, serpentine	L.P.	20/20	4+	3+	0	0	0	0	0	0	0	0	4+	4	20	105-106	Prompt, total	Rapid	20/60	20/20	Pain was outstanding feature here; relieved by 1 treatment
L.H.	Gon. iritis, left	L.P.	20/20	3+	0	0	3+	0	0	1+	0	0	0	4+	4	20	105-106.8	Prompt, total	Rapid	20/20-3	20/20	Minimal residual scarring Early treatment plus sulfathiazol gave excellent results

TABLE 3

IMPROVED: SYMPTOMATIC RELIEF, AND ARREST OF PROCESS, WITHOUT IMPROVEMENT OF VISION

Diagnosis	Prognosis at Start of Treatment	Number of Treatments Given	Response to Treatment	Remarks
Gon. ulcer of cornea	Poor	2	Relief of pain and arrest of gonorrhea	Treatment stopped because pt. noncoöperative. More treatment would have helped this case
Gon. ulcer of cornea	Hopeless	3	Relief of pain and arrest of gonorrhea	Eye was almost destroyed before treatment started. Enucleation done
Optic neuritis complication of cataract operation	Fair	4	Neuritis was checked, no visual improvement	Loss of vision was gradual but unchecked until fever therapy
Foreign body; Postop. infection of stump after enucleation	Poor	7	Relief of pain before enucleation and rapid improvement of post-op. infection	Aside from relief of pain, the most benefit was in treatment of dangerous infection of stump
Traumatic degeneration and infiltration, left eye with blindness	Hopeless, enucleation indicated	2	Some relief of pain obtained	Palliative relief the only object here
Panophthalmitis (occurring in blind eye due to old serpiginous ulcer)	Hopeless	2	Immediate relief of pain and inflammation	Enucleation of blind eye greatly facilitated by relief of inflammation
Recurrent corneal ulcer (Leucoma of cornea)	Hopeless due to leucoma	5	Complete, immediate relief of pain; healing of ulcer	Since fever treatment has no benefit on preëxisting scar tissue, the leucoma was unaffected. Further scarring is often prevented in such cases

therapy, and that the remainder would have had serious visual impairment in one or both eyes.

It is impractical, with the number of cases reviewed, to present case reports of all the cases. However, table 2 shows a detailed summarization of 10 typical cases in the excellent or satisfactory groups, selected because they demonstrated the usual response, rather than because they show successful results.

For comparison with the good results demonstrated in table 2, *all* of the unsatisfactory results are reviewed in tables 3 and 4.

Thus we are able to observe that of the

12 cases in which there were more or less unsatisfactory results, the prognosis in 8 was poor or hopeless at the outset. Of the remaining four, two patients refused further treatment. This leaves two patients with good or fair prognosis, of whom one received some benefit and was classed as improved, and one received no benefit at all because there was no particular indication for this type of treatment in that case. The relief of pain in many of these "unsatisfactory" cases not only justifies the treatment but is an immediate benefit not to be disregarded.

It should be noted that of the group of "Relapsed" cases, one patient was

physically unable to continue the treatments, two had ultimate recoveries despite relapses, and one had a relapse related to insufficient treatments, but his final vision was still much improved. Failure to eliminate infectious foci is a great contributory factor in these relapses.

This discussion of the cases not responding to treatment with more than

tion or loss of vision. (3) Photophobia. (4) Lacrimation. (5) Headache.

All of these symptoms are improved by fever treatment. The most dramatic relief afforded is the elimination of pain, usually effected by the first treatment. Lacrimation is also relieved, usually by the first treatment. Headaches and photophobia are next relieved, often by the first treat-

TABLE 4  
FAILED, NO VISUAL IMPROVEMENT OR RELIEF OF SYMPTOMS

Diagnosis	Prognosis at Start of Treatment	Number of Treatments Given	Response to Treatment	Remarks
Iritis, acute	Good	1	0	Patient too frightened to coöperate
Panophthalmitis	Poor	8	Slight relief of pain	Treatment given at too low temperatures for good results. Less than 104°F.
Retinitis, chronic	Poor	10	0	No benefit obtained which could be attributed to fever
Laceration of eyeball	Good	1	0	No reason for using fever in this type of case
Choroiditis, acute exudative	Good	1	Some relief of pain	Patient refused further treatment and left hospital

symptomatic improvement bears out the statement made previously that results with fever therapy depend upon early and thorough treatment. If destruction has already occurred the hypertherm can do no more than arrest the progress of the disease. If inadequate treatment is given, the maximum benefit cannot be obtained. In addition to this it is also important that adequate attention be given to infectious foci which may be the cause of, or contributing to, the disease process.

Much has been said of "relief of symptoms" without any specific statement as to the type of symptomatic relief afforded. The chief symptoms benefited by fever therapy in the above conditions are:

(1) Pain in the affected eye. (2) Diminu-

ment, usually by the second or third. The response of vision is varied, and accounts for the reason the treatment was stopped after too short a course in some of the earlier cases. Many patients have rapid visual improvement with the relief of the symptoms of pain and photophobia. Those cases, however, in which there is a plastic exudate, interstitial keratitis, or opacities of the vitreous often do not respond at all, as far as vision is concerned, for several treatments. After the fourth or fifth treatment these cases suddenly begin to clear, and with persistence of the treatment the exudate is absorbed. Absorption may be almost complete if treatment is kept up; if not, some visual defect may remain. The rule is, therefore,



to persist in the treatments, if the patient can tolerate them, for as long as any sign of improvement is present.

The relief of symptoms is accompanied by relief of signs observed by the examiner, as has been mentioned. These signs,

if deep, the healing depends on the duration, and whether they penetrate into the anterior chamber. If relatively recent and uncomplicated, comparatively rapid healing will occur, with no progress or complications of the ulcer other than scar-

TABLE 5  
RELAPSE AFTER PYRETOTHERAPY

Diagnosis	Prognosis	No. of Treatments	Response
Sympathetic ophthalmia, Rt. eye, L. eye previously enucleated following iridocyclitis	Poor, vision 20/200	21	Vision returned to 20/30 after ninth treatment but tended to relapse. Further treatment given to prevent relapse. Vision on discharge 20/40. Relapse in three months and patient returned for more treatment
Same case as above	Fair, vision 20/80	10	Vision returned to 20/40 and all symptoms again subsided. Vision will correct to 20/20, and remained unchanged when checked again in six months. Although listed under <i>relapse</i> , the final results were excellent.
Keratitis, traumatic	Guarded, vision 20/120	3	Relief of pain after each treatment, symptoms subsided but relapsed in 10 months. Patient did not have enough treatment according to present knowledge. Patient failed to have infectious foci removed as advised. Final vision 20/40
Keratitis, traumatic	Guarded, vision 20/200	7	Preëxisting central corneal opacity of four years' duration. The acute process was arrested by fever treatment with immediate relief of severe pain. Patient developed mild relapse one month after treatment. Handled by local treatment. Final vision 20/40. Patient failed to have infectious foci removed as advised
Corneal ulcer (duration 13 months)	Guarded	1	Physical condition of patient prevented more than one treatment. Ulcer healed slowly under local treatment and recurred in six months. Not enough treatment to evaluate results

as listed below, are somewhat varied, and, of course, not all related to the same diagnosis: Conjunctivitis. Ulceration of conjunctiva or of cornea. Scarring of cornea. Plastic exudate in the anterior chamber. Hypopyon. Posterior synechia. Inflammation of the uveal tract. Vitreous opacities. Retinitis. Edema of the optic nerve.

Relief of conjunctivitis is rapid. Healing of ulcers is rapid if they are super-

ring. Scarring of the cornea is benefited only in a prophylactic way. Fever therapy in corneal ulcers prevents any more than minimal scarring. Plastic exudate in the anterior chamber, after two or three treatments, is absorbed with amazing rapidity and thoroughness, leaving no residuals in most cases. Relief of posterior synechia depends upon the factors of early treatment and thoroughness, not

only of the fever therapy, but also of the local treatment in the eye. If well handled, excellent results are usually obtained. Inflammation of the uveal tract obtains almost unfailingly excellent end-results, in spite of surprisingly bad cases on admission in some instances. Vitreous opacities, if quite recent, will absorb; but, even when only of moderate duration, are somewhat resistant to treatment. There have not been enough cases presenting retinitis to gain much impression of results. What impression exists is not promising. Edema of the optic nerve subsides relatively rapidly. Since affections of the optic nerve are mostly syphilitic, this sign does not enter into this series, particularly.

Careful handling of these cases by the ophthalmologist is necessary. The usual local treatment measures are continued assiduously, even while the patient is in the cabinet. It is superfluous to enumerate here the various local measures necessary in the care of the eye diseases listed. It is important to stress, however, that these measures must be carried out until healing is complete just as if the patient were not being handled with fever therapy. The purpose of fever therapy is to supplement the standard treatment measures, not to supersede them. The physician in charge of fever therapy and the ophthalmologist must work in constant consultation in almost all of these cases. In this way it is possible to determine the frequency of the treatments necessary, the level of temperature desired, the duration of each treatment, and finally the point at which treatment can be terminated.

It should be emphasized that the danger of this method of treatment is negligible in trained hands, and in this series there were no complications of treatment other than a few cases of mild herpes labialis

after the first treatment, which disappeared after subsequent treatments.

### SUMMARY

1. The use of fever therapy by means of the hypertherm cabinet in the treatment of various acute inflammatory diseases of the eye (excluding syphilis) has been discussed. 2. Fifty-two consecutive and unselected cases of various inflammatory diseases of the eye treated in the hypertherm have been grouped by diagnosis and the results examined. 3. Excellent results were obtained in 25 cases, and satisfactory results in 12 cases, giving a total of 37 patients classed as cured. 4. The results in the remaining cases were: Improvement, 7; failure, 5; relapse, 4. These relatively unsatisfactory cases were discussed and certain conclusions obtained. 5. The specific effect of treatment in the relief of the various signs and symptoms was shown to be uniformly good.

### CONCLUSIONS

1. The results of pyretotherapy in the treatment of inflammatory diseases of the eye are excellent in many cases, offering the only means of saving partial or total vision.

2. The most striking immediate result of treatment is *relief of pain*. The restoration of vision is slightly more delayed, but very remarkable in most cases, depending on three factors: (a) the duration of the process before the start of fever therapy; (b) the number of treatments given while under the therapeutic regime; (c) the close coöperation of the ophthalmologist, first in persisting in the local treatment, and second in determining the point at which treatment is to be discontinued.

3. It is evident that much vision may be saved by this method of therapy, and

equally evident that it is not applied as much as possible even where it is available. It is desirable, therefore, that ophthalmologists become more aware of the usefulness of this therapeutic method, and ascertain the means at hand in their locality whereby they may make it rapidly available to selected patients.

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# JUVENILE CATARACT IN ASSOCIATION WITH DERMATOSIS\*

(CATARACTA SYNDERMATOTICA)

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From the time that Rothmund<sup>1</sup> in 1868 described the occurrence of juvenile cataracts associated with a peculiar skin degeneration in a family of two brothers who married two sisters, the interest of the medical profession was aroused. So far 37 cases have been reported in English and European literature. Of these, 15 were published in America, 20 in Europe, 1 in Australia, and 1 in England.

Evidently they are not frequent, and the purpose of this paper is not only to present another case but to bring out the characteristics of this unusual disease that affects the skin and the lens.

The outstanding symptoms of the disease are marked generally but not universally by:

1. Endocrine disturbances<sup>2</sup>
2. Skin pathology diagnosed as
  - a) Scleroderma
  - b) Neurodermatitis
3. Lens pathology

Of the endocrine-gland disturbances the most prominent are: Infantilism, poor body growth, premature graying of hair, underdevelopment of sex organs, and abnormal basal metabolism. Of the endocrine glands involved, the most common are thyroid, parathyroid, testicular and ovarian glands, although undeniably some of the cases show evidence of pluriglandular disturbance.

As seen from the cases reported in the literature, endocrine disturbances were observed 16 times, graying of hair in 8 cases, scleroderma in about 55 percent of cases, and neurodermatitis in 45 percent.

\* Read before the New York Clinical Society for Ophthalmology, February 1, 1943.

One must be particularly careful to differentiate the juvenile type of cataract known as cataracta syndermatotica, from the cases of cataract occurring in association with hypofunction of the parathyroid gland. The term *syndermatogenous cataract* was suggested by Kugelberg<sup>3</sup> in 1934, because the cataractous lens changes occur in association with abnormal skin changes.

It is well known that in endocrine disturbances such as tetany, myxedema,<sup>4</sup> disturbances of the sex-organs' function,<sup>5</sup> and in cases of myotonic disturbance<sup>6</sup> we are likely to find cataracts. These, however, differ from the juvenile cataracts which occur in association with the skin changes in Rothmund's disease.<sup>7</sup>

Of the skin changes, *scleroderma*, quite commonly found in Rothmund's disease, but not the cause of it, is itself of unknown origin. Some of the authors attribute it to

- (a) Endocrine disturbances — Hoffman<sup>8</sup>
- (b) Primary vascular disease—Kraus<sup>9</sup>
- (c) Damage to vegetative nerve centers—Curshmann<sup>10</sup>
- (d) Peculiar skin predisposition, aggravated by exogenous toxins (infection), trauma, exposure to cold and wet, and changes in the vascular system—Barkman<sup>11</sup>

It is characterized by a chronic localized or diffused induration and rigidity of the skin, which is tense, leatherlike, and cannot be pinched or lifted up, for it is bound down to the underlying structures. Associated with it is atrophy of subcutaneous fat and glands due to the pressure.

from increased fibrous and connective tissue. These changes mostly involve the breast, neck, forearms, and lower extremities. When the face is involved, facial hemiatrophy results (lack of expression).

*Neurodermatitis*, the next important symptom of the disease, is found in somewhat less than 50 percent of the cases. It is characterized by severe protracted itching, and a chronic eczema extremely obstinate to treatment, involving the face, the neck, and the flexor surfaces of the extremities. It is especially pronounced in the folds of the skin, resulting in a thickened, scaly, and eczematous condition. The face, because of lack of the usual folds and the grossly exaggerated thickened state, takes on a characteristic leonine appearance. The disease is not uncommonly associated with bronchial asthma and other allergic phenomena.

According to Ehrmann<sup>12</sup> the cause of neurodermatitis is primarily an endocrine disturbance involving the thyroid, ovarian, and pancreatic glands individually or severally. Last, but not least, it may be the result of digestive disturbances (chemical changes, interference with proper function of the Islands of Langerhans or mechanical motility of the bowel) and acid or subacid condition of the stomach.

Strandberg<sup>13</sup> agreed with Ehrmann that abnormal products of decomposition, not properly eliminated, become absorbed into the blood stream thereby resulting in irritation of the peripheral skin nerves, dermatographia, urticaria with severe itching, and lead finally to an eczematous condition of the skin because of constant scratching.

On the other hand, numerous other authors, among them Urbach,<sup>14</sup> are more conservative and cautious in expressing their opinion as to the cause of neuro-

dermatitis. They believe it to be a peculiar disturbance of the vegetative nervous system.

However that may be, it is by now clear that the causes of scleroderma and neurodermatitis are different. Although both may accompany the peculiar juvenile cataract in various individuals, it does not follow that either of the skin diseases is the cause of the cataract, but rather another symptom of the same disease.

The most characteristic symptom of Rothmund's disease is the lens changes. The lens opacity consists of numerous grayish-white dots of varying sizes which tend to become confluent in the central portion of the lens and scatter more diffusely toward the periphery. The posterior cortex is never so extensively involved as the anterior, and no cholesterol deposits are found as a rule, although Loewenstein<sup>15</sup> found multicolored cholesterol deposits in his case. Usually the nucleus of the lens is poorly visible, although it is unaffected. The main opacity is located axially in the anterior cortical layers, involving the superficial layers up to the capsule. Some authors claim that, on the whole, the morphologic picture of this cataract presents a remarkable resemblance to the cataracts caused by massive doses of X ray.<sup>16</sup>

In the following table an attempt is made to compile most of the specific cases described in literature thus far, clarifying them according to their outstanding symptoms.

From these tables it can be readily ascertained that scleroderma is the most common skin lesion, that prematurely gray hair is a quite common symptom, and that thyroid dysfunction is not at all rare.

#### CASE REPORT

C. B., a young man about 20 years of age, came with the complaint of a rapid

TABLE 1  
MALES

No.	Age yrs.	Skin Pathology	Other Pathology	Cataract	Primary Onset
1	40	Scleroderma	Snow-white hair	At 28 yrs.	C. I Sc. II
2	36	Scleroderma at 33 yrs.	Prematurely senile. Gray hair	At 29 yrs.	Sc. II C. I
3	35	Scleroderma at 20 yrs.		At 34 yrs.	C. II Sc. I
4	36	Scleroderma at 26 yrs.		At 32 yrs.	Sc. I C. I
5	25	Scleroderma at 24 yrs.	Stopped growing at age 10	At 22 yrs.	C. I Sc. II
6	40	Scleroderma of several years		At 7 yrs.	
7	44	Scleroderma at 7 yrs.	Atrophy of genital organs	At 13 yrs.	C. I Sc. II
8	29	Scleroderma at 7 yrs.	Sex organs poorly developed. Gray hair.	At 16 yrs.	C. Sc. II
9		Scleroderma at 7 yrs.	Sex organs poorly developed. Late puberty	At 17 yrs.	
10	32	Scleroderma at 7 yrs.	Infantilism. Lymphocytosis.	At 28 yrs.	C. I Sc. II
11	15	Eczema. Ichthyosis	Puberty at 15 yrs. Small stature	At 14 yrs.	C. I Sk. II
12	17	Eczema	Leonine facies	?	Sk. I C. II
13	25	Ichthyosis N. Dermatitis		?	C. II Sk. I
14	12	Eczema. Ichthyosis Dermographia	Asthma	Normal	Sk. I
15	42	Dermographia. Eczema	Leonine facies	Normal	Sk. I
16	28	Eczema. Prurigo "Besnier"	Asthma	?	C. I Sk. II

C. I = Cataract appeared first (eye symptoms are first in appearance)  
 Sc. II = Scleroderma appeared second  
 Sk. I = Skin changes appeared first

progressive loss of vision in both eyes for the past several months. Although his vision had never been good, for he was near-sighted, it did not interfere with his attendance at school. At the age of 15 years he started working for a living. Now his vision was so poor that he had to stop working.

His physical condition had always been

good except for a dry scalp, scaly and at times itchy skin, often breaking out in "sores," for which he was treated unsuccessfully for years. Appetite and elimination were good, weight was stationary, the family history unknown.

Physical examination revealed a youth of 20 years, rather well developed, of normal height and weight. His appear-

TABLE 2

## FEMALES

No.	Age yrs.	Skin Pathology	Other Pathology	Cataract	Primary Onset
1	38	Scleroderma at 22 yrs.	Snow-white hair	At 23 yrs.	Sk. I C. II
2	31	Scleroderma at 22 yrs.	Gray hair. Enlarged thyroid	At 25 yrs.	Sk. I C. II
3	37	Scleroderma	Snow-white hair	At 31 yrs.	Sk. I C. II
4	?	Scleroderma		?	?
5	?	Scleroderma		?	?
6	35	Scleroderma at 28 yrs.	Eunuchoid. Menstr. disturb.	At 32 yrs.	Sk. I C. II
7	32	Scleroderma	Thyroid enlarg. Tremor. Poor. hair.	At 32 yrs.	Sk. I C. II
8	37	Scleroderma	Gray hair. Basal m. +16	?	?
9	?	Scleroderma		?	?
10	30	Scleroderma	Goiter. Changes in sella turcica	?	?
11	9	Scaly dry skin Dermographia	Asthma. Enlarged thyroid.	?	?

ance was striking. The face, especially the forehead, the cheek, and the ears were coarse, dry, and scaly and lacked the usual folds, giving him a leonine expression. The skin of the rest of the body was likewise thickened, coarse and dry, with a lack of folds on the flexor surfaces. There was complete absence of hair on the abdomen; it was sparse in the axillae and arranged in a feminine way near the pubis. The sexual organs were small and undeveloped for the size of the body.

Laboratory tests gave the following results: Red blood corpuscles, 4.5 million; white blood corpuscles, 4,800; relative lymphocytosis, 16 percent eosinophilia. The blood chemistry was negative, as was also the urinalysis and the Wassermann reaction. The basal metabolism was -7.

*Eye examination.* The lids of both eyes

were thickened, dry, and scaly. It was almost impossible to evert the lids manually. The conjunctiva of the lids was thickened, that of the eyeball was of normal appearance. The cornea was clear, the anterior chamber somewhat deeper than normal, the iris normal.

The lens showed subcapsular freely scattered opacities involving mainly the central portion of the anterior cortical layer, although the posterior layers were also involved, but not so much. The opacities were densest at the axis of the lens. Toward the periphery the opacities became rather thin and scattered. There was a free zone at the extreme periphery of the lens. The vitreous was not clearly visible and the fundus was likewise not seen. The cataract of the right eye was far more developed than that of the left.

Vision: O.D. without correction was 20/200; with a +0.75D. sph. = 20/200;



O.S. without correction 20/100; with a +0.50D. sph. = 20/70.

*Operation.* Cataract extraction was performed on both eyes at a six-month interval and consisted of a discission and five days later a keratome incision with irrigation of the soft lens matter.

*Final result.* Vision 20/20 in each eye with correction.

### CONCLUSION

The important points to be remembered in Rothmund's disease are:

1. Occurrence of cataractous changes in rather young people with typical skin

changes which may or may not arise simultaneously.

2. Evidence of pluriglandular endocrine disturbances.

3. Skin changes although bearing a similarity are not always of the same origin and are not therefore the cause of the disease.

4. The development of the cataract is rapid and progressive.

5. The prognosis as to the operation and subsequent vision is favorable.

6. Fortunately the disease is not common.

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## CHOLESTERINOSIS LENTIS\*

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Cholesterinosis lentis constitutes a particular form of cataract of which neither the etiology nor the pathogeny is clear. It is first necessary to differentiate between this type and other similar types of cataracts. The latter are: (a) Calcareous cataract, which is milky white in color and does not have the shining appearance of cholesterinosis lenti. (b) Xanthomatosis lenti,<sup>1</sup> which presents widespread fatty deposits without particular form and appears only in young people. Etiologically it is in very close relation to Niemann-Pick's disease. (c) Hypermature cataract, the result of the proteolysis of the necrotic lens mass, appearing white or yellowish in color, with cretaceous deposits scattered throughout. (d) Diabetic subcapsular cataract, which is characterized by pathognomonic subcapsular changes in the posterior cortex. It is always bilateral and most frequent in young people.

In cholesterinosis lentis brilliant crystals appear in the posterior cortex of the lens, irregularly deposited. It is usually unilateral and appears at any age. Knowledge of the pathology of this type provides us with very valuable information for clinical observations.

How does cholesterol appear in the lens?

Is it an element in composition that appears after a disturbance in the lens or is it an element that is transported from without with the nutritious matter?

It was in 1831 that Schmidt<sup>2</sup> first noticed the presence of the cholesterol crystals in the anterior chamber of a patient and wrote, "From the frontal surface of a white cataract, there seems to liberate

itself, a shining powder, golden and very fine, which, trembling at first in the aqueous, falls like a thick carpet on the inferior surface of the anterior chamber." Since then it seems that all authors agree that the cholesterol originates in the crystalline lens. All relating publications (Poncet,<sup>3</sup> Königstein,<sup>4</sup> Desmarres,<sup>5</sup> Folin,<sup>6</sup> Scholer<sup>7</sup> arrive at the same conclusion: "Upon rupture of the lens capsule, cholesterol is deposited in the anterior chamber." As an explanation of this opinion, Jacobsen<sup>8</sup> in 1881 set forth that the cholesterol cannot possibly be a component which was transported through its nutrient matter to the crystalline lens, but was the product of a regressive metamorphosis of its albumin after a delayed absorption (Heilborn,<sup>9</sup> 1915). However, some of the experimental workers, such as Blassius,<sup>10</sup> Besserer,<sup>11</sup> and Heilborn,<sup>9</sup> have seriously questioned the existence of cholesterol in the lens. On the contrary there are important investigators such as Zehlender, Mathessen, and Jacobson,<sup>12</sup> representing earlier writers, and Kawarura<sup>13</sup> among the contemporary authors, who state with assurance that the normal crystalline lens contains cholesterol. Adams,<sup>14</sup> Neushiller,<sup>15</sup> Cahane,<sup>16</sup> and Salit<sup>17</sup> found in human cataractous lenses more than 0.25 percent cholesterol. Salit and O'Brien<sup>18</sup> accepted as positive the fact that there is a significant increase of cholesterol, both in aged and cataractous lenses. The strongest proof was advanced by Vogt,<sup>19</sup> who discovered that not only in complicated cataracts, but also in senile types, the formation of large cholesterol spots is not a rare occurrence. Lately, Sugita,<sup>20</sup> while examining a series of extracted cataracts, found fat deposited in

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the form of fine droplets in all parts of the lens. Joschichara<sup>21</sup> also noticed in a congenital cataract numerous cholesterol substances that appeared in the dark field when examined under the polarization microscope.

In spite of all these opinions, it may be said today that it has not been clearly proved that the chemical basis of this cholesterol is contained within the normal crystalline lens. It is known only that under certain conditions the lens is capable of presenting parts of local cholesteatosis. Chemicobiologically, only, is it certain that "The essential lipoids (phospholipoids, cholesterol) are necessary for the life of the cells and these substances presumably have some biological significance, of which we are, as yet, ignorant. It may be that the increase in fat is a secondary occurrence comparable to the common process of fatty deposition occurring in senile and degenerating tissues generally, depending essentially on a lessening of oxidative activity" (Duke-Elder<sup>22</sup>).

What is the pathogeny of these cholesteatosis?

An explanation may be derived from facts based upon known clinical and experimental evidence.

It is known that the crystalline lens possesses, among other elements, a quantity of lipoids. It is clear from the famous works of Goldsmith<sup>23</sup> that the lipoids increase, at an advanced age, following an alternating chemical play that occurs in the crystalline lens between the cysteine and the cystine. Actually, if any cataract is very carefully examined biomicroscopically, small drops of lipoids or fine elements of cholesterol will be discovered in the crystalline masses in about 80 percent of the cases. Other changes of the colloids and lipoids within the crystalline lens that present cholesterol elements are found in coronary cataract, rosette cataract, mature cataract, in various types of

senile and lamellar cataract, in nuclear cataract and various manifestations of cataract incipiens posterior. If we deny, then, even the actual existence of cholesterol in the crystalline lens, we can obtain it indirectly after a regressive metamorphosis or after a disturbance of these lipoids. But what is the pathogeny of this disturbance of the crystalline-lipoid complex, and what are the conditions that act to produce it?

The theories of the pathogeny of cholesterolinosis bulbi and lipoidosis bulbi have already been proved by one of us (P. G.<sup>24</sup>). In lipoidosis bulbi there must always have preceded a prolonged irritation of the corpus ciliaris or of the iris. This irritation causes alterations in the adjacent tissues, in the form of an infiltrative lipoid degeneration. This localized disturbance of the lipoid complex produces the appearance of cholesterol crystals in the form of an exudate as a secondary sign. Before attempting an explanation of the pathogeny of cholesterolinosis lentis, it must first be determined whether hypercholesterinemia could be a causative factor. There are many experimental investigations by Aschoff,<sup>25</sup> Versee,<sup>26</sup> Jesse,<sup>27</sup> Huth,<sup>28</sup> Röhrschneider,<sup>29</sup> and Joel<sup>30</sup> that have sought an explanation of this theory. All of these workers have concluded that, in animals, hypercholesterinemia can produce the appearance of cholesterol in the eye. However, after a long series of experiments one of us (P. G.<sup>31</sup>) has demonstrated that in man hypercholesterinemia does not produce the appearance of cholesterol in the human eye.

Turning now to an explanation of the pathogeny of cholesterolinosis lentis—that is, an explanation of this shining image with the small and large crystals placed one upon the other without definite form—two points immediately attract the attention of the examiner: 1. The cholesterol-

in crystals are always placed in the posterior half of the crystalline lens. 2. There always exists, at the same time, an alteration of the lens capsule.

These two clinical facts in relation to the aforementioned theory give a very clear pathogenic explanation. The first cause of this always exists outside the crystalline lens. An infiltrative alteration of the ciliary body, the zonula, or of the vitreous body (possibly after long irritation) can cause a relative alteration in part of the posterior crystalline lens. This alteration of the capsule appears like a fatty infiltration of this membrane. Secondly, it is dependent upon the intensity of the alteration before the crystalline masses suffer a disturbance in their lipid complex. The result of this disturbance is the appearance of the cholesterine under the phase of local cholesteatoses.

In reality, if one observes a sufficient number of cases, it will be proved that behind or adjacent to the central part of the cholesteatosis, the crystalline capsule is always altered; either infiltrated or swollen. This alteration is not primary in nature but secondary. Definite proof of this is to be obtained by examining the eye, and particularly the corpus vitreum, the ora serrata, and the corpus ciliaris in so far as possible, and, in general, all parts that surround the crystalline lens, in order to prove that other alterations are primary signs. It is of great importance that the examiner persist in a detailed examination of the corpus ciliaris. The examination should always be made with the contact glass that will allow the perception of the finest alteration of these internal structures. Troncoso<sup>32</sup> and Trantas<sup>33</sup> have presented lengthy discussions on the advantage of contact glasses for a detailed examination.

Cholesterinosis lentis is always a cataract of secondary nature, for it is brought about by changes outside the crystalline

lens. Retinosis pigmentosa, retinitis haemorrhagica, iridocyclitis, and uveitis are conditions most often causing cholesterinosis lentis. There is another condition that probably brings this about more often than the others, and that is highly toxic cyclitis latens. This inflammation of the corpus ciliaris is so slow that it is often developed, in many cases, without pain and lacking in clinical symptomatology.

It is possible that simultaneously with the advancement of the infiltration of the crystalline capsule, there is present an incipient cortical or lamellar or perinuclear cataract (in elderly patients). This disturbance of the crystalline-lens composition favors, without doubt, the interference of the lipid complex and causes the appearance of cholesterin crystals, more quickly and in greater quantities. In two previous works one of us (P. G.<sup>24</sup>) has explained the pathogeny of the appearance of cholesterin in the anterior cortex of the eye as well as in the posterior cortex. The conclusions reached can explain the cholesterinosis of the lens because of the fact that cholesterin crystals appear in the iris, the anterior chamber of the cornea, the hyaloid, or the retina after a sustained irritation of the corpus ciliaris or its adnexa.

#### SUMMARY

1. Pathogenic explanation of cholesterinosis lentis is based upon the pathogenic theory of lipoidosis bulbi. Conditions found outside the crystalline lens produce an infiltration of the posterior cortex of the crystalline-lens capsule. This infiltration follows a secondary disturbance of the lipid complex of the crystalline masses, producing the appearance of shining crystals of cholesterin.

2. Cholesterinosis lentis is always a secondary cataract, and we should persist in detailed examinations to discover the primary causative factor.

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# NOTES, CASES, INSTRUMENTS

## ERYTHEMA NODOSUM EPISCLERITIS

### A CASE REPORT

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A brief discussion and bibliography on this subject may be found in Duke-Elder's, "Textbook of ophthalmology."<sup>1</sup> One case in the English literature was reported by Green and Perry in 1939.<sup>2</sup>

One month prior to his admission to the hospital on March 15, 1943, the patient was off duty for four days because of fever and sore throat. On March 8th, he developed pain in both hips and the lower back, which made walking difficult. On March 14th, tender red spots appeared over the anterior and medial aspects of both legs. There was no previous history of arthritis, rheumatic fever, or skin eruptions.

The physical examination on admission revealed redness and exudate on the left tonsil, tenderness over both knee joints, and several moderately large, red, swollen nodules over the anterior aspects of both lower legs, typical of erythema nodosum. Temperature varied daily between 100° and 103°F.

The laboratory findings of March 16th were: Blood count, R.B.C. 4,940,000 with hemoglobin 85 percent; W.B.C. 13,750; 73 percent polymorphonuclears, 23 percent lymphocytes and 4 percent monocytes; electrocardiogram, normal; X-ray film of chest, normal; Kahn test, negative; blood sulfa-drug level, zero; blood cultures, no growth; Widal and undulant fever reactions, normal.

Salicylates were given for the first 5 days, with an average daily dose of 80

grains. Little improvement resulted in either symptoms or temperature, and the drug was discontinued on the sixth day. In the next 24 hours the patient received 120 grains of sulfathiazole and 40 grains of sodium bicarbonate. After the first few doses of this drug the patient became nauseated and vomited forcefully. The joint symptoms became worse, and a small macular rash appeared on both hands. The eyes were somewhat irritated and it was noticed that they were slightly red.

*Ocular examination:* Examination on March 23d revealed involvement of the external and internal bulbar conjunctiva of both eyes. There was no redness of either palpebral conjunctiva. The lesions consisted of several small, raised, yellowish nodules surrounded by deep redness fading into a pink and then finally surrounded by a slight bluish flush. The largest nodule was in the right outer angle and measured about 1½ mm. in diameter. There was a small subconjunctival hemorrhage in this region extending 3 mm. from the limbus. Pressure on the lid over these areas revealed slight tenderness but no pain. The nodules were movable on the sclera. The drawing shows the relative size and location as compared with the cornea (fig. 1). Above and below the cornea the bulbar conjunctiva was completely normal. Cornea, iris, lens, media, and fundus were normal upon bedside examination with loupe and ophthalmoscope.

The sulfathiazole was discontinued on March 23d, and the salicylates resumed as before. The macular eruption on the hands disappeared the next day. Three days later, on the 26th, the hyperemia of the inner angles was much diminished, but the nodules could still be made out. There

was still moderate hyperemia of both outer angles. Most distinctive was the yellowish discoloration present in the subconjunctival tissue, extending laterally and medially from the limbus about 9 mm. and fading into a faint bluish haze. The nodules were smaller but easily visible on top of the yellowish discoloration. The patient was comfortable except for some

nor exacerbation of either the eye signs or the erythema nodosum. The sulfathiazole was not resumed at this time because of his physical discomfort. Salicylates were resumed and again he clinically improved. On April 14th he was placed on 90 grains of sulfadiazine daily, so that on the 21st and 23d he had a blood level of over 8 mg. percent. No untoward symp-

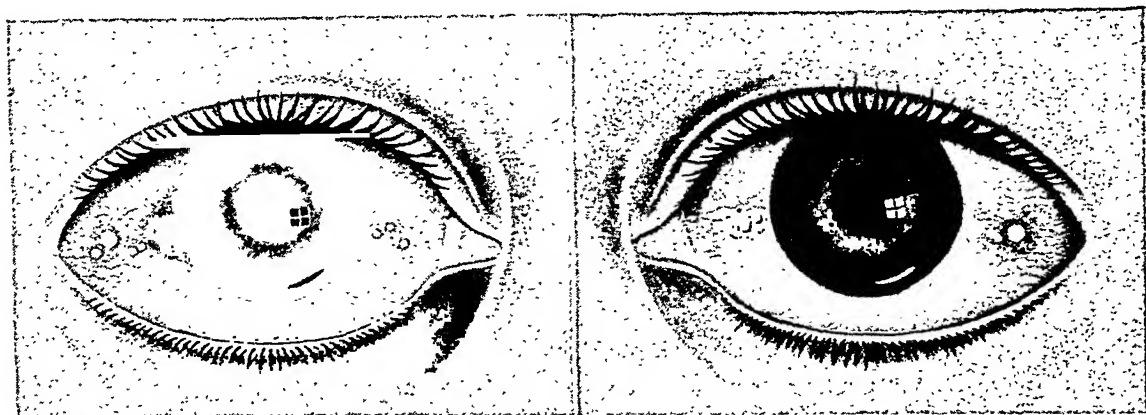


Fig. 1 (Anthony and Marshall). Erythema nodosum episcleritis.

slight joint pains and the red sore eruptions of the legs, which were subsiding.

On March 28th, the outer angle of the left eye was nearly clear with the exception of a moderate yellowish color. Nodules could still be made out in the other areas, the right outer angle showing the least improvement. The small subconjunctival hemorrhage of this area was partially absorbed.

The yellowish discoloration was the last sign to disappear, and the eyes were again normal on about April 7th, two weeks after the first observation. It was also at about this time that all signs of the nodules on the legs disappeared.

To determine if the eye lesions might reappear, all medication was stopped on the 29th of March for a period of 32 hours. The patient became very uncomfortable, with marked increase in joint symptoms and a rise in temperature from 100° to 103°F. There was no recurrence

toms resulted and no special improvement occurred.

His general condition improved very gradually and occasional evening temperature rises were present until the middle of June. In view of the convalescence required, following three months in bed, he was transferred to an Army Hospital in the Zone of the Interior.

#### DISCUSSION

One might suggest that the ocular lesion was caused by a sensitivity to sulfonamides. However, the eye changes persisted for two weeks after withdrawal of the drug and were not reproduced by later use of another sulfonamide. It would seem that the lesion was aggravated by the withdrawal of the salicylates not unlike the exacerbation that occurred in the joints. The ocular signs reported by Green and Perry, in 1939, are almost an exact



duplicate of those seen in this case, and occurred in a patient having erythema nodosum. No sulfa drugs were used in their case.

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# PRIMARY MENINGOCOCCIC CONJUNCTIVITIS TREATED BY SULFADIAZINE

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Endogenous meningococcic conjunctivitis occurs as a rare complication of epidemic meningitis. Still more rare is exogenous meningococcic conjunctivitis uncomplicated by general symptoms. While numerous reports in the literature attest the favorable effect of the sulfonamides on meningococcic meningitis, no reference as to their effect on exogenous meningococcic conjunctivitis has appeared as yet. For this reason the following case report would seem to be of interest.

*Report of case.* W. T. S., a young white man, aged 21 years, was admitted to the Station Hospital, Drew Field, Florida, on March 27, 1943, with German measles of one day's duration. There was a typical punctate rash with posterior auricular-node enlargement. The rash disappeared on the fifth day after admission, and the patient appeared to be well on April 1st. At no time were there any ocular signs or symptoms.

On the evening of April 2d the onset of a bilateral conjunctivitis was noted by the nurse in charge, and when seen by the writer on the morning of April 3d the patient exhibited a severe bilateral acute purulent conjunctivitis. The conjunctiva showed marked papillary hyper-

trophy, and there was a profuse purulent discharge. Both corneas were clear. Gram-stained smears of the exudate showed predominant polymorphonuclear leucocytes and many typical Gram-negative intracellular diplococci of gonococcus-like morphology. A tentative diagnosis of gonorrheal ophthalmia was made, and the patient was examined for evidence of urethral gonorrhea. No previous history nor evidence of the disease was found, however, and the patient denied having had any recent sexual contact. Treatment consisting of full doses of sulfadiazine by mouth, combined with boric-acid-solution irrigations every two hours and followed by instillations of 5-percent sulfathiazole ointment, was instituted.

On April 5th both eyes showed distinct improvement, and the discharge had become scanty. By April 12th, the conjunctival secretion had stopped but there was still some slight residual inflammation. On April 16th, the cultures taken on the second day of the disease were reported to be meningococcus, and this diagnosis was later verified by the laboratory of the Fourth Service Command. On April 20th, after three successive negative smears and cultures had been obtained, the sulfadiazine and local eye treatment were discontinued, and the patient was discharged on April 25th. Vision was 20/20 in each eye, and the conjunctiva had returned to normal.

The sulfadiazine treatment consisted of an initial dose of 2.0 gm. followed by 1.0

gm. of the drug every four hours day and night, combined with an equal amount of sodium bicarbonate, for the first four days. After this the sulfadiazine and bicarbonate were reduced to 1.0 gm. four times daily for the remainder of the treatment period. Blood levels varied from 3 mg. percent to 20 mg. percent, but averaged 6 mg. percent. The blood picture remained normal during the treatment period. A throat culture taken on April 14th was negative for the meningococcus. There was no febrile reaction at any time during the course of the disease.

#### COMMENT

The conjunctivitis responded rapidly and satisfactorily to sulfonamide therapy, and no extensions to the blood stream or to the meninges occurred. The rapidity of the response was comparable to that seen by the writer in sulfonamide-treated cases of gonorrheal ophthalmia.

The source of the infection was undetermined, but it may have been a ward contamination, since two cases of meningococcal meningitis were under treatment at the time that the patient was confined with German measles. These cases were isolated in separate rooms, however, while the patient under discussion was kept on the ward. During the previous two months sporadic cases of meningococcal meningitis had been appearing on the Field.

The reported case well illustrates the necessity of examination by culture of Gram-negative diplococci in purulent conjunctivitis to make a differential diagnosis between gonorrheal ophthalmia and primary meningococcal conjunctivitis, which may be clinically indistinguishable. Needless to say the medicolegal and social consequences of confusing them are potentially very great.

*Station Hospital.*

#### UNUSUAL EYE FINDINGS IN IDENTICAL TWINS\*

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Similar eye findings are of interest in individuals, still more in identical twins. Attention has been drawn to this by the not-infrequent reports in the literature. This additional report is published to note the similar eye findings in identical boy twins due to congenital factors.

One was seen at the age of five months because of cleft palate, and the other at the age of four years. They had similar eye findings of high compound myopic astigmatism in their right eyes and congenital complicated cataracts in their left eyes. One subsequently had a detached retina in the right eye.

Their deliveries were normal, and there were no congenital defects except those described.

There were two other children in this family, both older. A sister, aged seven years, was seen in December, 1942. She presented a high myopic astigmatism, the vision without correction being 1/60 in each eye. When corrected, the vision was 6/20 + 1 in each eye with a -10.00D. sph.  $\approx$  -0.75D. cyl. ax. 180° for the right eye and a -10.00D. sph.  $\approx$  -1.25D. cyl. ax. 180° for the left eye. She was mentally alert and exhibited no other physical defects, although both fundi showed pallor of the discs with retraction of the scleral rings, which is often seen in high myopia.

A brother, aged nine years, was seen at the same time as the sister. He had progressed normally in school and was in good physical condition. His vision was 6/18-1 in the right eye and 6/15 in the left eye, without correction. He had a

\* From the Department of Ophthalmology, Quain and Ramstad Clinic.

compound hyperopic astigmatism and was wearing a  $+0.50D.$  sph.  $\approx +0.50D.$  cyl. ax.  $90^\circ$  for the right eye and a  $+0.75D.$  sph.  $\approx +0.50D.$  cyl. ax.  $90^\circ$  for the left eye; this correction brought his vision to 6/6.5-2 in the right eye and 6/6 in the left. The fundi were normal.

The father was interviewed, but not examined. He stated that he had never had any difficulty of vision, nor had any of his family.

The mother has poor vision. Her home life is incompatible and she is now in the State Hospital for the Insane. As far as can be determined her family history is negative. A report on her condition from the State Hospital ophthalmologist is as follows:

"Vision is very poor. The right eye reveals a high myopia, fluid vitreous with opacities, cataractous lens, partial detachment of the retina, and degenerative choroiditis resembling luetic type. The left eye reveals a similar condition except that the lens is dislocated temporarily. Iridodonesis is present, and the retina is not detached."

The blood-Wassermann test was positive and the spinal fluid negative in 1942. Her diagnosis is schizophrenia, paranoid type, and latent syphilis.

As stated before, one twin, Elmer M., was seen in the Clinic for congenital cleft palate involving the posterior two thirds of the hard palate, the entire soft palate, and the uvula. This was repaired by means of a two-stage operation at the ages of three and four years, with complete cure. This boy had a speech defect from this condition with some mental retardation as noted by a psychologist. Both conditions improved after surgery was performed. The general physical findings, including urinalysis, blood examination, Kahn and Wassermann tests, were negative with the exception of hy-

pertrophy of the tonsils and adenoids with chronic infection. This patient subsequently had his tonsils and adenoids removed and preputial adhesions loosened.

A peculiar eye condition was observed prior to the first operation on the palate, and the child was seen in consultation by the Eye Department three years later, on January 13, 1941. The eye findings were as follows: Vision was not obtained. The eyelids were normal externally and opened and closed freely. The ocular movements were unimpaired. The conjunctiva and cornea were clear. Tension was normal to palpation. The fields were not obtained. The pupils and reflexes were normal. In the right eye the fundus showed a high myopia with pallor of the disc and retraction of the scleral ring. In the left eye the pupil was small, reacted poorly, and was occluded; the fundus could not be seen. The lens was cataractous, congenital in type.

The left eye was operated upon, a crucial discission being performed. The membrane was leathery, calcified, and nearly impossible to cut. Seven months later, iridectomy and linear extraction of the lens were performed. The mass was adherent to the iris, and after extraction a grayish membrane (the posterior capsule) persisted. This was incised and a serosanguineous fluid obtained. There was no loss of vitreous. Seven-and-one-half months later a V-shaped discission was performed. The membrane was thick, difficult to cut, and did not retract. No improvement in the vision was noted, and the fundus never could be seen. Further operative procedure was abandoned.

The right eye was refracted, and when last seen on August 20, 1943, the patient's correction was a  $-13.50D.$  sph.  $\approx -1.25D.$  cyl. ax.  $180^\circ$ , and the vision was 2/60.

The second twin, Albert M., four years

old, was seen on March 19, 1942, because of poor vision. His general physical examination, blood studies, urinalysis, Kahn and Wassermann tests were negative. There was no deformity of the palate, but hypertrophied tonsils with obstructing adenoids were present together with a phimosis. He had surgery for these conditions with a good result.

His vision was poor. The eyes were normal in size, shape, and position. The lids opened and closed freely, the ocular movements were unimpaired, and the conjunctivas and corneas were clear. In the right eye the pupil was round, it dilated well under cycloplegia, and responded to light, in accommodation, and convergence. The media were clear. The fundus was myopic and showed pallor of the disc. The patient was given a prescription of  $-18.50D.$  sph.  $\approx -2.50D.$  cyl. ax.  $180^\circ$  for the refractive error in his right eye.

Externally the left eye was negative. The pupil was fixed and occluded, but reacted slightly to light. The lens was cataractous, and the fundus was not seen.

Discission was attempted. The lens could be moved, but could not be cut through. The findings were similar to those in his twin brother's eye, and further surgery was not done. This boy got along well until November 2, 1942, when his father stated that he suddenly lost his sight in the right eye. When seen, the pupil was dilated, but reacted. He had light perception, but no light projection. There was a nearly complete detachment of the retina from the 1- to the 6-o'clock position temporally, involving the macula and most of the disc. The vitreous was hazy. The prognosis was poor.

Reattachment was attempted on November 6, 1942. One month after dismissal from the hospital the patient could see moving objects. There was some reattachment, but the vitreous was so cloudy

that the fundus could not be seen well enough to undertake further operative procedure.

Albert M., last seen here on August 20, 1943, had slight light perception, but no light projection. The lens was hazy and there were posterior corneal opacities. The vitreous was cloudy and the fundus was not seen.

The boys are now mentally alert and in good physical condition. They have been sent to the State School for the Blind for instruction.

In view of the findings in the mother's case, the conditions were undoubtedly congenital and probably inherited. There is no hope of vision in the eyes with the congenital cataracts, which probably have a congenital degeneration as well. The prognosis for the myopic eyes is poor, as this condition is, no doubt, due, in part, to a defect in the germ plasm. It may result in a detachment of the retina in the twin Elmer M. as it did in his brother's case, although his myopia is not so great.

*Quain and Ramstad Clinic.*

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## A MODIFIED FILM ADAPTER FOR RETINAL PHOTOGRAPHY\*

FERDINAND L. P. KOCH, M.D., AND  
ARTHUR F. WILLIAMS  
*Saint Paul*

Those who prefer the bantam film pack for photography of the human eye-grounds, whether for color or for black-and-white delineation, have been compelled of necessity either to design their own film carriers or to rely on the Rollex adapter<sup>1, 2</sup> (figs. 1, 2, 3). The expense of the former commonly does not justify

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Fig. 1 (Koch and Williams). Rollex adapter in place at end of tube in plane of photographic layer with focusing eyepiece of Zeiss-Norden retinal camera above.

the results obtained, while the latter possesses inherent vagaries that are directly attributable to the lack of sturdy precision construction. The hinged outer shell, or housing, usually gives satisfactory service, but the inner film holder proper, which is removable from the housing, has

several faults each of which may be responsible for, or is causal to, the tearing of the film strip and the subsequent loss of the exposures made.

The unmodified body, or holder, or the adapter is simple in design and construction: Each of two light metal rollers situated close to the base at each end is maintained in position by means of permanent insertion of the roller ends into a depressed axle hole on each side of each end of the base of the holder; however, these rollers unfortunately are not cushioned either by bushings or bearings. This lack results in a gradual and irregular enlargement of all four axle holes as the adapter continues in use. This, in turn, causes irregular alignment and subsequent eventual tearing of the film strip.

The holder, as well as its two parallel vertical sides, is stamped from thin light metal approximately 0.5 mm. in thickness. The sides arise from the flat base at an angle of 90 degrees and the film itself is so maintained in the holder that the metal roll, or spool, on which the film is packed is positioned just above but slightly inward from each of the two rollers over which the film travels. The film is brought around underneath the holder so that the free end can be carried

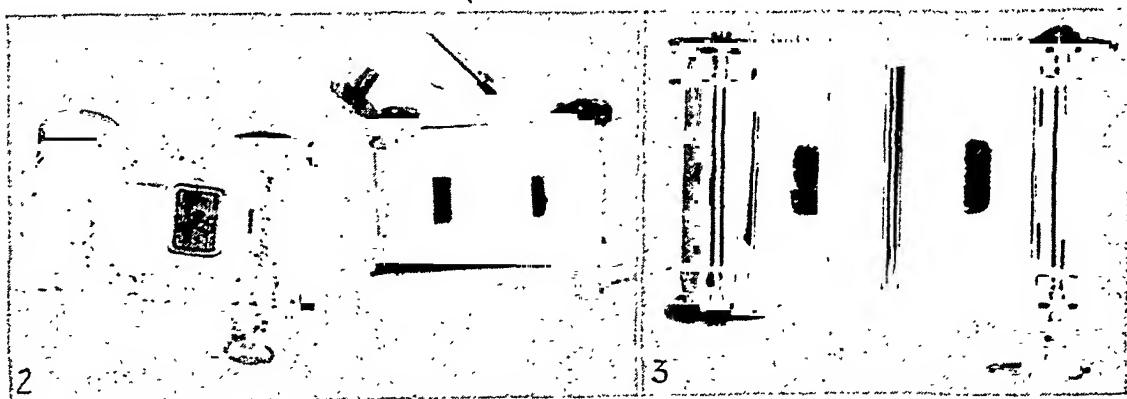


Fig. 2 (Koch and Williams). Rollex adapter housing to left and film holder proper to right. Fig. 3. Detail of film holder of Rollex adapter showing empty bantam spools with reducing studs at each end of each spool. Hand-turning key is seen at lower right-hand corner of holder.

up and forward and locked into the forward spool the rotating movement of which is initiated and controlled by a small, hand-turning key. The latter can rotate only in a counter-clockwise direction. The key rarely is able to withstand the relatively extreme force necessary to effect progressive movement of the film when the latter is subjected to

shear off, and this constitutes another annoying structural weakness that must be considered together with those already mentioned in designing a new film holder or in modifying the fairly commonly used Rollex adapter.

One of us (F. K.) in conjunction with Mr. Kern Larkin of The Institute of Ophthalmology, New York City, found

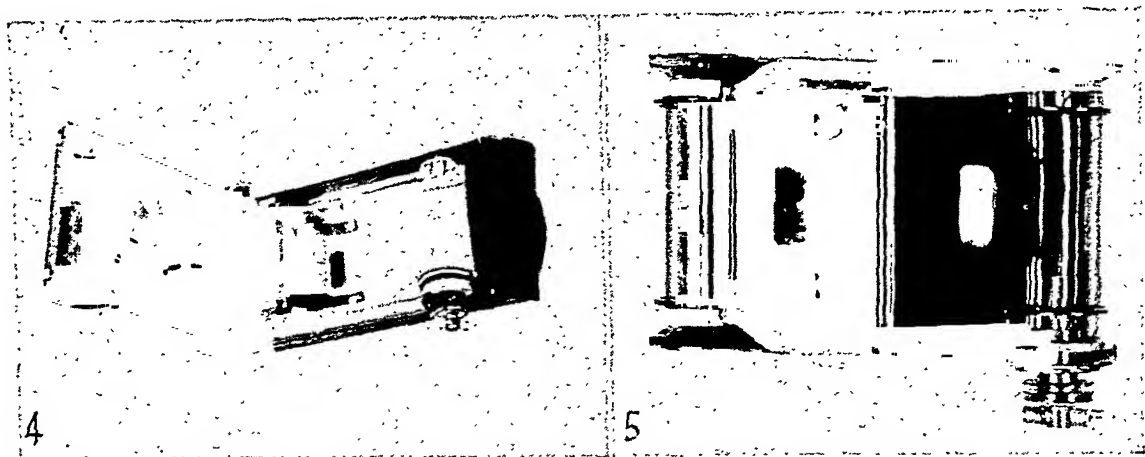


Fig. 4 (Koch and Williams). Film holder of sturdy brass construction, in place in housing. Bright surfaces proved to be unsatisfactory. Designed in conjunction with Mr. Kern Larkin. Fig. 5. Modification of film holder, or carrier, showing detail of thin spring strip above for support of forward spool to the right and the supporting hooked loops for the rearward spool to the left. These new parts ordinarily are blackened with dull lacquer but they are shown here in white for clarification.

stresses occasioned by irregularities of the holes in which the rollers turn on their axes. The film spools are seated in small stamped-out grooves that do not permit of their easy rotation. The forward spool locks into position by means of resistance furnished by a very weak spring seat at the end of the spool opposite the turning key.

The holder accommodates 127 film without the use of studs, as Bogart<sup>8</sup> recently has pointed out; however, when 35-mm. film is to be used it is always necessary to insert studs, or reducing ends, at both ends of each spool. These studs carry small, protruding restraining pins which are received into the ends of lengthwise open slots in the spools, but these pins not infrequently break or

it expedient, several years ago, to construct a film holder that appreciably increased spring-seat resistance and prevented slipping of the forward, or activating, spool while undergoing rotation (fig. 4). This greatly reduced the loss of film from mechanical disabilities but, since greater strength had been obtained by the use of a heavy, rigid brass base, another difficulty arose: It was not feasible to effect a properly dull patina or to oxidize inexpensively the gleaming brass surface. Painted finishes tended to flake and chip. It became necessary to develop an entirely new table of amperage and exposure values because the antihalation properties of the color film were not always sufficiently adequate to obviate retroillumination from the underlying

brightly reflective surface of the new holder.

It seemed desirable, then, to incorporate these same features of sturdiness into the base supplied as an integral part of the Rollex adapter. This we believe we have accomplished without the use of additional important metallic materials and without increasing appreciably the weight of the device; nor have we sacrificed the blackened, or oxidized, surfaces of the original holder proper. The changes may be effected in any even only modestly equipped instrument shop.

Our modifications have been effected by drill-punching into previously determined positions six to eight small, additional pieces of metal five to seven of which, respectively, may be fabricated from any light-weight alloy at hand but one of which should be tempered ferrous metal since it is utilized as a spring strip. The latter is patterned to comma-shape to form a rearward rectangular base and a flat, ovoid, spatulate forward end. Onto the inner surface of this ovoid end there is rivet-mounted centrally a small, rounded nubbin, 5 to 6 mm. in height. This snugly receives the open end of the film spool opposite the turning key and takes the place of one of the reducing studs previously mentioned. The ovoid, forward end of the spring strip narrows downward and backward at a 20-degree angle into a continuation of the strip the bottom edge of which closely juxtaposes the inner surface of the base of the holder proper. The outer surface of the rearward end of the strip is applied to a small, flat, rectangular metallic block which, after riveting, holds the strip 3 mm. inward from the lower inner surface of the side of the holder. This position is permanently secured by through-and-through punch-riveting the strip, block, and side of the holder. The forward end of this spring then is free and

elevated and parallel to the side of the holder, so that the forward spool rotates easily against the firm resistance offered by the unanchored spatulate end of the spring strip (fig. 5). It is necessary, however, to interpose one reducing stud between the socket of the turning key and the end of the film spool itself.

The rear spool is held securely in place by punch-riveting a curved, hooked piece of metal onto the upper inner surface of the rearward one third of each vertical side of the holder. These two small pieces are so fashioned as to provide a forward, flat rectangle from the rear end of each of which there stems a rigid strip that curves progressively backward, inward, downward, upward, and then forward to form a loop to receive the ends of the film spool when the latter is brought downward and backward from slightly forward and above to be inserted into position as described (fig. 5). This modification for receiving the rearward spool obviates the use of the two reducing studs previously employed. This decrease in the number of moving parts further adds to ease of operation.

It is desirable in some of the Rollex models, in addition to the above modifications, to rivet a thin metallic strip along each side of the bottom surface of the holder itself. These strips, of necessity, will vary slightly in length, breadth, and width, but their proper placement has the advantage of providing an exactly measured surface track for the guidance of the confined film strip as it progresses from the rear, or second and packed spool, to the forward receiving spool along the bottom aspect of the holder proper; furthermore, it also aids in preventing the metal rollers from becoming so axle-worn that they would rotate irregularly.

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## REFRACTION CLINIC\*

DISCUSSION BY ALBERT E.  
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Boston, Massachusetts

## Case 1

A three-year-old girl, in whose left eye there had been about 10° of esotropia for distance and near, during the past eight months, was presented for examination.

## EXAMINATION

Under atropine, she would accept O.D. +2.50D. sph.; O.S. -3.50D. sph.  $\approx$  -2.50D. cyl. ax. 180°.

What should be done in this case?

## DISCUSSION

Can the squint be explained on the basis of excessive accommodation? We know that accommodation cannot occur in one eye without being expended in equal amount in the other. If a child fixates with the hyperopic eye, accommodation will be required, and it is not unlikely that this accommodation will cause an over-convergence effect or esotropia.

The fact that the hypermetropia is not high (+2.50D. sph.) and yet is capable of producing a squint, is explained by the fact that the vision in the left eye is relatively poor. Therefore, little fusion amplitude can be present to offset or neutralize the over-convergence response.

Thus, for all intents and purposes, the squint must be evaluated essentially in terms of the right eye.

## TREATMENT

For immediate treatment it is well to consider this case as one of potential accommodative esotropia. In that case, we should fully correct the hyperopic error in the right eye to suppress all excessive accommodative effort. The left eye should be corrected for another reason: to improve the visual acuity as far as possible by sharpening the focus on the retina. However, we must be careful not to correct the myopia so fully that accommodation will become necessary, since at this stage we are attempting to suppress accommodative activity.

For this reason I would suggest correcting the astigmatic error, but well undercorrecting the spherical error O.S. and fully correcting O.D. Prescription: O.D. +2.50D. sph.; O.S. -1.50D. sph.  $\approx$  -2.50D. cyl. ax. 180°. Assuming that this would make the eyes straight, one could then attempt to improve vision in the left eye further by prescribing amblyopic exercises for the near vision: coloring pictures, and the like.

I do not believe we can hope for full binocular fixation with all refinements in view of the high difference in refraction (anistropia.)

In the event the squint was not corrected by this method, one would probably resort to surgery. This should be postponed until it has been proved that:

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1. Glasses do not help. 2. A resultant exotropia is not too likely to occur (because there will be more divergent effect as the head grows in size).

### QUESTIONS

House Officer: Is it not true that many children of this age have latent hypermetropia (+2.50D.) without a squint?

Dr. Sloane: It is true that this amount of latent hypermetropia is a common finding, but in this child the binocular status of vision has already been handicapped by the high anisometropia, so that there is not an adequate desire to use both eyes together to hinder or restrict an excessive reaction on the part of convergence to accommodation.

H. O.: Would you not expect the myopic left eye to be an exotropic eye rather than in an esotropic position?

Dr. S.: In this situation, there are two reasons that prompt an esotropic position for the left eye rather than a divergent one:

1. It is not the error of the eye itself that determines the position, but rather the demand on accommodation and the indirect demand on convergence. In this case, although the left eye is myopic, the demands on accommodation are made by the right eye, which is hyperopic, and the same amount of accommodation that goes to the right eye is also going to the left eye.
2. The orbit in a child under five tends to direct an eye that is not in use to a convergent deviation. Later the orbits tend to produce a divergent position in an unused eye. It is this transition from the convergent to a divergent direction that is frequently responsible for neutralizing a convergent squint, and it is to this sort of situation that one refers

when he says, "My son grew out of his cross-eyes."

H. O.: Would it not be feasible to occlude the right eye and build up vision in the left eye with a proper glass and then fully correct both eyes to emmetropia and train fusion at that time?

Dr. S.: Theoretically one could equalize the retinal images with a correction, but we could not know until the child is older how much his visual acuity improved, and, in the meantime, we may be exposing him to a handicap through not using his better eye. For practical purposes it would be best to allow him to see well with his right eye, correct his strabismus if possible with glasses, and improve the amblyopic left eye by amblyopic exercises for near.

### Case 2

A woman, aged 42 years, reported for examination, complaining of difficulty in seeing at near. She was wearing: O.D. +4.00D. sph.; O.S. +4.00D. sph. Uncorrected vision in each eye was 20/200. With a +4.50D. sph. for each eye, vision was 20/20. Add. +0.75D. sph. Wells I. With these lenses vertical and horizontal orthophoria was present.

### DISCUSSION

Obviously the symptoms are referable to the combination of her requiring a greater plus value for distance and the onset of her presbyopia. The question that we are to decide is whether or not bifocals are indicated. People who have never worn bifocals before usually find it difficult to make the adjustment. Moreover, bifocals have certain objectionable features; such as, implying old age. (This is an important objection for many people.) Furthermore, at best, bifocals represent a compromise so that certain areas of the field have their clarity sacrificed in

the interest of the reading portion. On the other hand, there are definite advantages to bifocals, since they make immediately available a near and far correction without necessitating a change of glasses. Another factor favoring the prescription of bifocals here is that it is easier to get used to a weak segment ( $+0.75D.$ ) than a stronger one.

I have found that bifocals are best tolerated when that situation is present where one cannot read at all with the distance glasses and yet can read through the reading segment. In other words, the patient has no choice as to which portion of the glass he must use in order to read. In cases where only a weak addition (like  $+0.75D.$ ) is required for the near correction, the patient is usually able to read everything except fine print with the distance lenses. It is true that this ability to read with the distance lens cannot be maintained, nor is it always comfortable, but for purposes of transient vision it suffices. Thus this patient with her glasses made up as bifocals would be able to read through her distance glass, but be able to read still better through the bifocal segment. The difference between the distance and near segments therefore is not one of being *able* or *not being able* to see, but simply of seeing more clearly through the "add." Since for most purposes fine near vision is not requisite, the patient will not know whether to look through the segment, which is unnatural, or through the center of the glass, which is more natural. It is preferable to correct the vision for such eyes in the following ways:

Solution 1. Prescribe the full distance correction in single-vision lenses. These would serve for all ordinary work since distance vision will be good, and a person aged 40 years has about  $3.50D.$  of accommodation to help for most near work.

In addition, give her the correction for near vision, also in a single-vision lens, for prolonged near work. I like to refer to this latter as a "library spectacle."

Solution 2. Order a distance glass in single-vision lenses and order *for near work* a bifocal. Wear the bifocal only for reading; this allows the person to get used to the bifocals gradually, subjecting him to none of their disadvantages. They later may be used entirely if the patient wishes.

3. Order bifocals where the occupation of the person is such that the most precise near vision should be available as well as the most precise far vision at the same time.

#### QUESTIONS

House Officer: What is the weakest bifocal strength (presbyopic add) that you would order?

Dr. Sloane: I usually start with  $+1.50D.$  sph. add. I occasionally prescribe  $+1.25$  add and only in unusual situations do I order less as a bifocal add.

H. O.: How does method 2 help solve the problem?

Dr. S.: In the first place, the patient is going to wear the bifocals only for reading. Here you require precise vision, and the person will easily be able to tell through which section of the glass she reads more comfortably. She will also have the opportunity gradually to accustom herself to other problems encountered in the use of bifocals. People of this age find it difficult to appreciate that their near vision should be different from what it was just a few year ago, and it is much easier to allow their reading glasses to bring home to them this fact than to talk them into wearing bifocals for constant use.

243 Charles Street.

# SOCIETY PROCEEDINGS

EDITED BY DR. DONALD J. LYLE

## ROYAL SOCIETY OF MEDICINE

### SECTION OF OPHTHALMOLOGY

October 9, 1942

MR. FRANK A. JULER, *chairman*

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#### RECURRING JUVENILE VITREOUS HEMORRHAGE

MR. FRANK A. JULER said that the condition known in this country as Eales's disease was first described in 1880.

A summary of the literature and a description of the disease were given in 1932 by H. P. Hutchinson. Since that date there have been few references to it here, but on the Continent and in America it has received some attention.

Hutchinson (1932) concluded (1) that no constitutional disease is usually present, but often some measure of lowered vitality seems to exist, (2) that there is no satisfactory evidence that tuberculosis is a cause, (3) that the disease is probably due to a deficiency in some blood constituent or to the presence of some toxic product causing damage to the capillary endothelium with resulting diapedesis. He mentioned, too, a possible vitamin deficiency allied to scurvy, although no symptoms of scurvy except epistaxis have been noticed.

Lawson (1935), in a discussion on diseases of the blood, stated that Eales's disease was characterized by a marked increase in the coagulation time of the blood. Mr. Juler said that he had not been able to find any confirmation of this nor had his own observations shown that

this was true. As Hutchinson says, "Deficiency in calcium, prolonged bleeding time, and delayed coagulation seem to be ruled out in almost every case in which these points have been investigated."

R. T. Paton (1938) described five cases, and concluded that the condition was always traumatic, toxic, or infective.

Jeandelize and Drouet (1936) attributed the disease to an endocrine defect. They asserted that there was a condition of hyperpituitarism which might be either primary or secondary to hyper- or hypothyroidism or to a dysfunction of the adrenals or gonads. Its presence was shown by the detection in the urine of a melanosome-dispersing factor. The only other evidence which they gave was (1) a narrowing of the visual fields, chiefly bitemporal, amounting to 10 or 20 degrees, and (2) hypertension of the retinal arteries.

Recent work by Noble and others (1938) on the posterior lobe of the pituitary has shown that injection of its extract produced pressor effects and hyperglycemia, sometimes with achlorhydria and hyperchromic anemia, while the urine of the experimental animals contained substances producing pressor and anti-diuretic effects; from a test on the frog a melanosome-dispersing action is obtained. Idris Jones (1938) described a case in which these findings were detected clinically and diagnosed as due to an overactivity of the posterior lobe of the pituitary gland. His patient was a man, 26 years old, and the disability lasted only a few months. There was no vitreous hemorrhage.

Dax (1938) reported the presence of a melanosome-dispersing substance in the blood and urine of eight adult mentally

defective patients with retinitis pigmentosa. Idris Jones said that he would hesitate to say that this substance is pathognomonic of hyperpituitarism, but should there be other evidence of excessive pituitary action, then it could be used as a confirmation.

McArevey and Somerville-Large (1939) reported two cases of Eales's disease in which there was a low excretion of vitamin C in the urine; neither patient had suffered a relapse since that diet was augmented. The period of freedom from recurrence was, however, not stated. Several observers, including Hutchinson (1932) have suggested that some deficiency condition may be present in this disease, and the above observations invite confirmation.

Harris (1940, 1942) recently found that school children showed a low level of vitamin C at the end of the winter, and that the present average was lower than in a pre-war period.

The symptomatology of severe vitamin-C defect was described by Crandon (1940).

These researches indicated that ascorbic acid is stored in the body, and that a high blood and urine content was found only after saturation had been reached. The determination of the body content, therefore, requires more than a simple estimation of the amount of vitamin C in the urine or plasma.

In the cases reported by Mr. Juler no investigations were made on this possibility, though from clinical experience during two years of war it did not appear that Eales's disease was on the increase, as one would expect if an ascorbic-acid deficiency of a mild type were in some way a factor.

In "Modern trends in ophthalmology" (Ridley and Sorsby, 1940) Redflob emphasizes the presence of an actual periphlebitis of a tuberculous nature, an ex-

planation which was strongly supported by Axenfeld, Stock, and others. He refers also to Marchesani's theory that Eales's disease is a manifestation of Buerger's disease (thrombo-angiitis obliterans). Marchesani's patients had circulatory disturbances varying from a simple sensation of cold to a spontaneous gangrene of the extremities. Kokott (1935) investigated five cases; no evidence of Buerger's disease was discovered, nor had any symptoms of this kind been detected in the cases observed by Mr. Juler.

Duke-Elder (1940) stated that Eales's disease was the commonest type of tuberculous periphlebitis, but that it may also occur as the result of septic foci, Buerger's disease, helminthiasis, delay in blood coagulation time, endocrine defects, and calcium deficiency. "The main feature in most cases is the normality of the general metabolism."

With regard to tuberculosis, the absence of clinical evidence in most cases is definite, but cases in which there were active pulmonary lesions were reported by Bonnet, and others (1936), and Kokott (1935), while Somerville-Large (McArevey and Large, 1939) saw three cases of Eales's disease with old-standing tuberculous lesions in the hilar glands. Microscopic examination was not possible, but Fleischer in an excised eye found a single focus of inflammation in the ciliary body, hemorrhages along the retinal veins and on the retinal surface, with tuberculous nodules in the venous walls. Gilbert (1935) found tubercle bacilli in a nodule in the wall of a vein; the eye had been excised for secondary glaucoma in a young man suffering from severe pulmonary tuberculosis: it was not a typical case of Eales's disease but it proved that tuberculous periphlebitis does occur.

From Mr. Juler's personal observations the appearances in the fundus are in the

most cases obscured by the grossness and density of the vitreous opacity, but in some of the less-severe attacks it is possible to see the apparent origin of the hemorrhage and in others a residue can be seen when the hemorrhage has cleared.

Mr. Juler presented eight cases in which there was a striking absence of any tangible general disease, except in one in which there was a chronic osteomyelitis of the great trochanter.

In no case was any evidence of tuberculosis obtained. This was in contrast to the findings in a recent study of chronic iridocyclitis (Brooks and others, 1940) in which clinical or radiologic evidence of tuberculosis elsewhere in the body was present in 25 of the 40 patients. Another negative feature was the absence of any general tendency to phlebitis or venous thrombosis.

On the contrary, all the patients except the one with bone disease were physically and mentally in good health. Possible sources of sepsis, such as tooth or tonsillar pockets, were not found during routine examination. Investigations concerning a possible hyperpituitarism and vitamin deficiency had not been carried out. In only one case was the blood pressure above the normal for the age of the patient; there was no increase in the color density detected in the routine blood counts, such as might have been found if a posterior-lobe hyperfunction had been present.

In three of the series of eight cases, iridocyclitis was present and foci of choroiditis were found in one other. The iridocyclitis was nonrecurring and for the most part of a mild type.

The ophthalmoscopic study of this series suggested that in many the hemorrhage occurred from one or more branches of a retinal vein, and that recurrence may have derived from the same site, leaving little residue beyond a twist-

ing and kinking of the vessel, sometimes associated with a localized traction forward of the retina. It has been recorded by several observers that occasionally no change can be found in the fundus after the vitreous has cleared. This has led to the suggestion that a diapedesis rather than a loss of continuity supplies the actual hemorrhage.

Although some eyes are undoubtedly badly damaged, the majority retain good vision. In many of the cases reported in the literature and in those which form the basis of this report, hemorrhages do not recur after a varying period. In Hutchinson's cases (1932) this was from six months to four years.

Of the cases reported by Mr. Juler, only one had been watched a sufficient length of time to be certain that there was no further danger. In that patient, seven years had elapsed since the last hemorrhage, which was one of five over a period of three years. In another, the right eye had many relapses over a period of five years, finishing with an iritis, and has been free for 13 months. His left eye had suffered several hemorrhages during a period of 11 months and has been free for 8 months. Two others have been free for eight months, one after five hemorrhages in  $5\frac{1}{2}$  years, a second after four hemorrhages in  $1\frac{1}{2}$  years. The intervals between the attacks vary from a few weeks to three years, but the average is approximately nine months.

One may conclude that in the great majority of attacks the visual acuity is only temporarily impaired, but that there is always danger of a serious attack during the period of susceptibility. Even after these severe attacks the eyes have a fair chance of good recovery.

Treatment consists of complete bed rest for a few days at the onset, in order to help clotting at the site of the rupture.

None of the coagulant drugs appears

to be of any value. Intravenous injections of calcium gluconate and chloride in one of Mr. Juler's cases were not followed by any shortening of the coagulation time. In the same way hemoplastin and vitamin K cannot be expected to be of value. The hemorrhage is not due to any deficiency in the coagulation power of the blood, it must be due to the local lesion in the vessel wall.

The general well-being of the patient is most important. The ideal is a sheltered life, with plenty of sleep, good food, and gentle exercise. In the background is the prevention of recurrences. The periphlebitis or perivasculitis in the area concerned is usually of a mildly infective nature, but any definite focus may require radical treatment. Apart from this, it may be well to attack the infection by general empirical means, such as protein-shock therapy by means of the intravenous injection of T.A.B. vaccine. Such treatment might stop further infection, although it need not be expected to strengthen the resistance of weakened walls.

The other possibility of stopping recurrences is by diathermy. In his Bowman lecture, Weve (1939) pointed out many uses for the high-frequency treatment, and in certain cases of Eales's disease it might be suitable to application. The patients in some of Mr. Juler's cases appeared to have bled from the same vessel on succeeding occasions. It would seem justifiable to produce a reaction over the area affected so as to include the "phlebitis sector" in the ensuing scar. A surface application would suffice, and if it were within 14 mm. of the limbus the ensuing defect in the visual field should not be large.

The treatment of vitreous hemorrhage is uncertain if the hemorrhage is very great. The clearing does not seem to depend on age, for, Mr. Juler states, he has

seen an improvement of vision from the perception of hand movements to 6/18 in three weeks' time in a 67-year-old woman who had a mild degree of hypertension.

Organization of vitreous hemorrhage by endothelial proliferation frequently does occur, and the pathology of formation of blood cysts in the vitreous was recently demonstrated by Wolff before the Ophthalmological Society of the United Kingdom. Once these fibrous walls and bands have developed, they will remain, and indeed detachment of the retina is known occasionally to result.

In the present series vitreous aspiration has been used on one occasion only, and with a resulting iritis and detachment of the retina; however, in the treatment of traumatic vitreous hemorrhage it is certainly useful. With a preliminary surface diathermy at the site of the puncture, the danger of hemorrhage is reduced, while detachment should not occur if the puncture is made at the "site of election"—namely, the pars plana—at a point 6.5 to 7.5 mm. from the limbus.

With such precautions, in the treatment of vitreous hemorrhage from pathologic causes there should also be some improvement.

As an alternative to aspiration Weve (1939) has suggested diathermic puncture of the sclera following a local surface coagulation; if necessary, a certain amount of fluid can be sucked or pressed out. It is indicated after traumatic or operative hemorrhage, and in vitreous opacities due to chronic inflammation.

Other methods of treatment for the clearing of severe hemorrhage are: (1) short-wave diathermy, (2) subconjunctival or retro-orbital injection of hypertonic saline. The latter is probably of no value, whatever, except for psychologic reasons.



# NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

November 2, 1942

DR. ISADORE GIVNER, *presiding*

## EXHIBIT ON NEURO-OPHTHALMOLOGY

DR. DONALD J. LYLE presented an exhibit that illustrated graphically the effect of brain diseases on the eyes. The diseases studied included neoplasms, diseases of the blood vessels, and various types of inflammations.

## RETINAL CHRONAXIA IN HEALTH

DR. BENJAMIN FRIEDMAN presented a paper on this subject which will be published in this Journal.

## RELATIONSHIP OF THE CEREBROSPINAL-FLUID SYSTEM TO OPHTHALMOLOGY

DR. DONALD J. LYLE outlined the embryologic development of the brain, in which the neural tube undergoes vesiculation in the parts of greatest growth. These vesicles, which are called ventricles, are joined, and through them the cerebrospinal fluid passes, finally to reach and bathe the cerebral surface. The ventricles are molded by central visual paths and other ophthalmologic structures which are frequently implicated in lesions of the cerebrospinal-fluid system.

Hydrocephalus, caused by an excess of production of cerebrospinal fluid, a defect in absorption, or a blockage of its flow by tumors, inflammations, blood clots, or other causes, frequently produces choked discs, visual-field changes, and involvement of the sensory and motor nerves to the eyes and adjacent structures.

Lesions in the temporal and occipital horns of the lateral ventricles frequently produce visual-field changes by implicating the optic radiations. Lesions involving the third ventricle frequently affect the optic tract and chiasm at the anterior end,

which affection may be due to a blockage of the aqueduct of Sylvius at the posterior end.

The nuclei of the nerves to the eye muscles are subject to lesions in the aqueduct of Sylvius and the fourth ventricle as they lie in the ventricle wall.

The emerging nerves in their course through the subarachnoid spaces from the brain or brain stem to the orbits may also be affected by inflammation and pressure from tumors, blood clots, and other causes.

The cerebrospinal-fluid system in its relationship to neuro-ophthalmology is of paramount importance, and clinical ophthalmologists should have a working knowledge of this subject.

*Discussion.* Dr. Alfred Kestenbaum stated that the dura is partly divided into two layers, a parietal and a visceral one. Three intermeningeal spaces may be thus differentiated: (1) the subarachnoid space between the pia and the arachnoidea; (2) the subdural space between the arachnoidea and the visceral dura; (3) the "epidural" space between the visceral and the parietal layer of the dura. In the spinal canal there are, as a matter of fact, these three well-separated spaces.

In the skull the subdural space is normally only a virtual one. The subarachnoid space is known as the cisternae—as, for example, the cisterna of the optic chiasm—and is filled with cerebrospinal fluid. The intracranial part of the optic nerve, the chiasma, and the optic tracts run through the subarachnoid space as do all large basal arteries, except the internal carotids. In contrast to the arteries, the entire venous system—the sinus at the convexity as well as the system of the cavernous sinuses—lies in the "epidural" space. The cavernous-sinus system and the hypophysis are separated by the visceral dura from the optic chiasma. This has the following significance: the

so-called intracranial pressure is present only in the subarachnoid space and within the brain. The venous-sinus system, however, situated in the epidural space, is protected by the dense dura; the pressure on the venous vessels is therefore more independent of the intracranial pressure (Sabanski). Otherwise in instances of highly increased intracranial pressure the blood from the orbit could not enter the skull at all. Therefore Sabanski, who found the diastolic pressure in the retinal veins (measured by Bailliar's ophthalmodynamometry) to be almost equal to the intracranial pressure, had to explain this fact by the relation of the vein to the subarachnoid space in the optic nerve, and not by the pressure relations in the cavernous-sinus system.

The difference in the pressure-conditions between the "epidural" space, in which the hypophysis is situated, and the subarachnoid space, which continues into the sheaths of the optic nerve, has to be considered in the explanation of the fact that tumors of the hypophysis almost never cause a choked disc.

The subarachnoid space and the subdural space, but not the "epidural" one, continue into the optic nerve up to the lamina cribrosa of the disc. Therefore the subarachnoid space of the optic nerve is in open communication with the subarachnoid space of the skull, as Tsuboi has emphasized. The pressure in the subarachnoid space of the optic nerve is therefore almost identical with the intracranial pressure and with the pressure found on lumbar puncture (in the recumbent position). The lamina cribrosa virtually separates two pressure spaces: the intracranial (better subarachnoid) space and the intraocular space. If the lamina cribrosa were a very elastic membrane, its position would be a direct expression of the relation between intracranial and intraocular pressure. On increasing the

former or decreasing the latter it should advance; on increasing the latter it should be bent backward. The small degree of elasticity of the lamina hinders such an extensive bending, but this point deserves attention in the explanation of many facts: the advancement of the lamina in papilledema, which Duke-Elder emphasizes; the occurrence of "papilledema" after perforation of the eyeball; the sometimes observed decrease or even disappearance of an excavation in recent cases of glaucoma after decrease of the tension; the dependence of the pressure of the retinal veins on the intracranial pressure (Baurman); the mechanism in primary optic atrophy according to Sabanski and Lauber.

In conclusion Dr. Kestenbaum stressed the facts that (1) the orbital veins open into the "epidural" space, which is relatively independent of the intracranial pressure; (2) the hypophysis lies in a "pressure-space" other than that of the optic pathways; (3) the lamina cribrosa of the disc forms a thin separating wall between two pressure-spaces, the intraocular space and the subarachnoid space, and therefore between the intraocular pressure and the intracranial pressure.

Dr. Ralph I. Lloyd stated that Dr. Lyle had shown the importance of the ventricular system in the diagnosis of brain conditions. Several theories have been offered to explain choked discs but the most reasonable, it seems, is Oppenheim's. He claims that the fluid escape from the ventricles into the submeningeal spaces is blocked by pressure upon the narrowest part, the iter. Distension of the third ventricle ensues, producing pressure upon the optic chiasm immediately below. This pressure blocks the return flow of lymph along the perineural spaces of the optic nerves, which, in turn, inhibits the flow of venous blood in the optic nerve anterior to the bony canal where the central artery

and vein enter and depart. Lantern slides were shown in support of this theory. The first showed a tumor of the cerebello-pontine angle, tumor in place, and the second, the effects of the pressure it exerts upon the cerebellum, resulting in marked atrophy of the lobe of the affected side. The next two slides showed the dilated third ventricle in this case and the normal ventricle. The next two slides showed the petrous portion of the temporal bone from this case with the atrophy of the bone about the auditory-nerve entrance and also a normal petrous bone. Dr. Lloyd pointed out that in brain tumors with choked disc there is no great quantity of fluid escape when the meningeal membranes are opened. The pent-up fluid is in the ventricles, and a trocar introduced preferably into the extremity of the posterior horn of the lateral ventricle allows this to escape and is the usual practice in operations to lower the pressure.

#### THE PUPILLARY REFLEX TO DARKNESS

DR. OTTO LOWENSTEIN stated that, until 1939, it had generally been supposed that the same mechanism was involved in the pupillary reflex to light as in the reflex to darkness; that is, the response to a short interval of darkness of a pupil that has been adapted to light. In that year, Lowenstein and Franceschetti showed for the first time that the two reflexes are independent of one another.

The reflex to darkness is elicited clinically by two flashlights, so arranged that the light from each flashlight reaches only one eye. After a short period of adaptation to these lights, one of them is extinguished for about a second. This "darkness stimulus" produces a reaction consisting of three phases: a primary phase of dilation, a contraction phase which begins after the darkness stimulus comes to an end, and a third phase of redilation

in which the normal pupil regains its original width. The reaction takes place both directly and consensually. As compared to the light reflex of the same individual, the dimensions of the reflex to darkness are considerably less. In a person, for example, whose contraction to light amounts to three millimeters, the dilation to darkness amounts to only two-thirds of a millimeter. During the darkness period, the reaction to darkness can be observed only clinically in the consensually reacting eye; pupillographically, the reaction of both eyes can be recorded during the entire period of reaction.

In cats, the reaction to darkness is as great as the reaction to light. The redilation phase, however, is not found; this is also true of monkeys, rabbits, and pigeons. It is of interest that in pathologic conditions in man, the phase of redilation disappears more readily than do the other phases.

In pathologic cases, any phase of the darkness reflex may be absent, independently of the other phases, and independently, too, of the reaction to light. For example, one might find cases in which good contraction is manifested in the light reaction but the redilation is inhibited, whereas the reflex to darkness shows a good dilation phase, and vice versa.

A case is shown in which, after the surgical removal of a pinealoma, the light reflex was absent; the reflex to darkness, however, was exaggerated in its first phase (dilation) although the third phase (redilation) was absent. This shows dissociation of the nervous pathways of pupillary control for the reaction to light and to darkness. We are not able to state the exact location of the lesion, for no anatomic evidence is present, but there must exist at least one point in the brain where the pathways of the two reflexes are not identical.

*Discussion.* Dr. Otto Marburg gave a review of the pathways for pupillary reflexes. He emphasized that the anterior median nucleus proper only (not the vertical limb of Edinger-Westphal's nucleus) is the motor nucleus for the light reflex. Edinger-Westphal's nucleus is a sympathetic nucleus, and as new investigations with Mettler on cyclopioid brain have shown, no fibers from this nucleus enter into the oculomotor nerve. The fibers of this nucleus cross the side and enter into the tegmentum, thence running into the spinal cord. As for the dark reflex, the exact investigations of Lowenstein are convincing. In the retina there are solely cones and rods (that is, color and light receptors); there may be a receptor also for darkness. But in the receptor layer of the calcarine area there are only two different kinds of cells: light and color receptors as revealed by investigations on monkeys that see by night only. (Vogt, Henschen's studies on *Perodicticus potto*.) It may be that there is a similar mechanism as for sleep (two different centers for falling asleep and for awakening), but that remains to be proved.

Dr. Mark J. Schoenberg presented a series of pupillographic curves from cases of glaucoma. These curves brought out a number of anomalies some of which were: (1) a slight disturbance of the first phase and a marked disturbance of the second phase, (2) the second phase is very similar to that found in normal monkeys.

Dr. Isadore Givner pointed out the value of the reaction to darkness in differentiating Adie's phenomena from the Argyll Robertson pupil. There are two types of darkness reflex in Adie's disease. The first shows the dilation to darkness but no subsequent contraction and redilation. The consensual reflex to this reaction when the affected eye is stimulated is normal. When, however, the nearer nor-

mal eye is stimulated the dilation to darkness in the affected eye is also diminished; there is, as well, an absence of the contraction and redilation following. The second type shows no reaction at all in the affected eye and a markedly reduced darkness dilation effect in the consensually acting eye. When, however, the nearer normal eye is studied, there is a diminution in dilation to darkness in this eye and an absence of reaction in the affected eye. Dr. Lowenstein believes that actually both eyes are affected in Adie's disease though one eye is outstandingly so. In the Argyll Robertson pupil there is no reaction to darkness either directly or consensually, whether or not either eye is stimulated by darkness.

#### OCULAR MANIFESTATIONS OF INTRACRANIAL PATHOLOGY

DR. E. A. SPIEGEL discussed the local-diagnostic significance of visual disturbances, eye-muscle palsies, and of nystagmus caused by intracranial pathology. He found, with N. Scala, that there is a second type of central vertical nystagmus, besides that seen in lesions of the vestibular nuclei. This second type of vertical nystagmus appears in the acute stages of cerebellar lesions, particularly in certain positions of the head, and is considered to be the result of a release of vestibulo-ocular reflex arcs from cerebellar inhibition. This result may shed some light upon the controversial question whether nystagmus occurs in cerebellar lesions. There seems to exist general agreement that cerebellar tumors or abscesses affecting the vestibular nuclei by pressure or edema may induce nystagmus. It is, however, a moot question whether nonspace-taking lesions that are restricted to the cerebellum may cause the appearance of nystagmus. Some authors admit this possibility, others deny it. The present series of experiments

seems to confirm the former opinion, since we observed nystagmus in cerebellar lesions with the vestibular nuclei and their extracerebellar pathways histologically intact. These experiments further showed that cerebellar nystagmus may escape observation if one examines in the normal position of the head only, so that the examination for nystagmus in cerebellar lesions should routinely include the observation of the eyeballs in the normal as well as in abnormal positions of the head.

*Discussion.* Dr. Alfred Kestenbaum stated that two kinds of vertical jerky nystagmus are generally known. In one group a lesion of the region of the collicular plate is found anatomically, in the other group a lesion of the superior part of Deiter's nucleus. The first kind may be explained as a gaze-nystagmus—a disturbance of upward gaze, as paralysis of

gaze may also occur in a lesion of the collicular region; the second kind may be explained as a central vestibular nystagmus. The interesting results of the experiments of Spiegel would show the existence of a third kind of vertical jerky nystagmus as a consequence of a cerebellar lesion, if such a nystagmus were observed clinically, too.

Dr. Frank C. Keil stressed the importance to the ophthalmologist of Dr. Spiegel's contributions pertaining to the central connections and pathways of the ocular nerves. He cited briefly a few case reports of lesions of the ocular nerves of unverified etiology and stated that it was not always possible to follow the different phases of ocular palsies, as the true cause of a lesion may become manifest only months or years later.

Jesse M. Levitt,  
*Secretary.*

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## THE OPHTHALMOLOGIST'S ROLE IN THE PROGRAM FOR THE PARTIALLY SEEING CHILD

The book by Winifred Hathaway on "Education and health of the partially seeing child" is reviewed in this issue of the Journal. The program is in its infancy, not having been initiated in the United States until 1913. Only a small part of the estimated 50,000 eligible children have as yet been enrolled in sight-saving classes. There has been a diversity of opinion as regards the amount of vision desirable for enrollment in this program, the upper limit of acuity in some

states being 20/70 whereas in others it is as low as 20/200 in the better eye with suitable glasses. Only the phases of this subject referred to in the title of this editorial are here considered.

The ophthalmologist enters into the picture in two different roles. He is primarily the most important factor in the selection of pupils for these classes. Secondly, his must be the continued supervision of the patients if they are admitted to the classes. Superficially the task of selection and bringing about the inclusion of the desired children into sight-remedial classes seems simple. Actually, however, this is not the case, there being an inher-

ent disinclination on the part of the parents to have the child segregated in any manner from his fellows, to say nothing of the mechanical difficulties of transportation and added expense. From the doctor's standpoint it is important that he shall be convinced of the value of these sight-conservation classes or he will make a poor salesman.

The first screening must usually be done in the schools. This requires the education of school personnel or of the school physician in the matters of vision taking and of the significance of sight-conservation classes. After defective vision is found the child is usually referred to a refractionist. In some places this must be a physician, but in others optometrists are acceptable to the school boards. Whatever the instructions, parents often take their children to optometrists, so that they also must be aware of the sight-conservation program and of its merits.

It is advisable to be prepared to combat parental objections, which are almost sure to arise, by elimination of the probable points at issue in advance. For example, the child should not be segregated completely from his fellows, but should recite as much as possible with his own class and be in the special classroom only for those studies to which conservation of eyesight especially pertains. For athletics and other nonsight-taxing pursuits these children should be with their classmates, since it is important that they do not get the point of view that they are handicapped and segregated. In this regard it is vital that children with defects other than ophthalmic be not included in these groups. For example, it is never wise to send the mentally defective child to such a class merely to get him out of the way because he is a nuisance in the normal group.

Transportation is a real problem. In order to accompany the younger child it is sometimes possible to have an older

child transferred to a school in which there is a sight-saving class for the younger child with defective vision. In some cities school busses are available. The expense, if it cannot be borne by the family, should be provided for by the city.

Everything should be done to take away any possible stigma connected with enrollment in these classes. The ophthalmologist should know of the program in his own community and be interested in seeing that it is being conducted in as intelligent and efficient a manner as possible.

Regarding the question of what children should be enrolled in the classes, it is relatively simple to ascertain the best vision with glasses. But there is a divergence of opinion regarding such matters as myopia. Many doctors believe that the child with marked myopia should be in a conservation-of-sight class, irrespective of whether the vision is below that of the allowable limit in his community or not; whereas others do not share these views as to the ill effect of use of the myopic eye. Such points as these will have to be decided in the individual case by the examining physician. An ophthalmologist who is wholeheartedly in favor of the program (and it is incredible that any well-informed doctor should be otherwise) will be more successful in persuading the parents that the child in question should have the benefit of these classes. Usually, the parent is entirely unaware of the sight-saving classes and has to be convinced of their value. The first reaction is almost always one of opposition to them, and this is especially true if the child is doing well in his school work. It is generally only when the grades begin to fall and the child in becoming a misfit that the reluctance of the parents for such classes is overcome. It is very often difficult to convince parents in the former case of the value of the class in protecting the child's vision for the future.

The physician's task is greatly helped



if a certain amount of favorable propaganda is carried on by the school board. An attractive method of doing this is the portrayal of the classes and their work in the rotogravure section of Sunday papers. In most cities there are parent-teacher associations. Lectures to them on this subject would be very helpful in popularizing the effort. The objections are usually from ignorance rather than from any other factor.

The care of the child when entered into these classes is no different from that of a partially seeing child under any circumstances. The only feature that need be stressed is the necessity of systematic ocular examinations, as the condition of the child's eyes may change relatively rapidly. Frequent reexaminations in the schools are necessary also. The entire program is a very worthy one and will be greatly helped by the active participation of the ophthalmologist.

Lawrence T. Post.

### GLAUCOMA AND NASAL SINUSES

Concerning the mechanism of certain cases to which we attach the diagnosis of "secondary glaucoma" we know a little. With regard to the causation and development, particularly in the earlier stages, of the disorder to which we apply the title "simple glaucoma" we know almost nothing.

The expression "simple glaucoma" implies more or less that we are dealing with an insidious type of glaucoma for which we are unable to establish a cause.

It would be encouraging to suppose that we could assign a clearly defined and well understood cause to this disease. Proof of such a discovery would constitute one of the greatest modern advances in the science of medicine. This would be particularly true if the cause discovered were of

such a nature that the cause could be corrected or remedied, and that such remedial action would either prevent or cure simple glaucoma.

It is interesting to reflect that as soon as (if ever) we find such a cause, or perhaps a related group of causes, we shall have to discontinue the use of the term "simple glaucoma" and must regard every case of glaucoma as secondary. Simple glaucoma is among a number of conditions (as for example essential vascular hypertension) whose titles are confessions of ignorance.

Many attempts have been made to trace a connection between simple glaucoma and various types of focal infection. The incriminated sources have included the teeth, the tonsils, the nasal sinuses, the gall bladder, the genito-urinary tract, and the large intestine. Infection existing in any one of these areas has been more or less frequently blamed upon another of the group, an example being the attribution of sinus disease to dental granulomatata.

Last year, before the American Academy of Ophthalmology and Otolaryngology, Berens and Nilson (Transactions American Academy of Ophthalmology and Otolaryngology, 48th meeting, 1944, January-February, page 121) discussed evidence which seemed to them to point to the nasal accessory sinuses, among other foci of infection, as playing a prominent part in the etiology of so-called chronic simple glaucoma. These authors urged more particularly that, if it could be shown that a large proportion of cases of simple glaucoma occurring in one eye only, or especially marked on one side, coexisted with nasal-sinus disease on the same side, this fact would constitute a strong ground for assuming a causal connection between the two conditions.

It is stated that of fifty-three cases included in the study, in nineteen the glaucomatous condition was more marked in

the left eye and the evidence of nasal involvement was either confined to the left side or more pronounced on that side. In eighteen cases there was suggested a similar relationship on the right side.

Especially in view of recent researches with regard to the viruses, it seems not unreasonable to suppose that many inhabitants of the so-called temperate zone who have been severely or frequently attacked by influenza or the common cold are likely to nurture a chronic and perhaps lifelong, although usually inactive, infection of the nasal sinuses. Moreover, an extremely mild and hardly recognizable infection of one kind or another has often been shown to be capable of just as much secondary mischief as an active and more clearly demonstrable infection.

Thus the field of investigation upon which Berens and Nilson have set out lends itself much more readily to somewhat vague conjecture than to positive demonstration. The difficulties with which the subject bristles are vigorously illustrated in Woods's discussion of the paper of Berens and Nilson. The authors of the paper themselves admit that "the difficulties of proving a definite relationship between the simultaneous occurrence of sinus disease and chronic simple glaucoma from the experimental or even the clinical standpoint seemed to be unsurmountable."

Judgment concerning the relationship between glaucoma and any focal infection is rendered difficult by the fact that the essential degenerative changes more directly responsible for the glaucoma are likely to be permanently established before the causative factor can be investigated, recognized, or removed. A further difficulty in establishing the chain of evidence is the fact that the glaucoma, once established, must be persistently treated with miotics or combated with a surgical operation.

There is a definite possibility that the

only causal connection between what we call simple glaucoma, on the one hand, and chronic sinusitis or other focal infection, on the other hand, is through their common relationship to a degenerative process in the reticulo-endothelial system. Such a degenerative tendency might owe its existence to one or more acute or chronic infections, or might itself have created a reduced power of resistance in the patient. From this point of view, the problem of preventing simple glaucoma may be tantamount to the difficult task of finding a means for the cure or prevention of essential degenerative changes in the body as a whole, and particularly in its endothelial circulatory structures, including the canal of Schlemm.

W. H. Crisp.

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## BOOK NOTICES

EDUCATION AND HEALTH OF THE PARTIALLY SEEING CHILD. By Winifred Hathaway. Clothbound, 182 pages, 26 plates, 9 figures. Published for the National Society for the Prevention of Blindness, Inc., New York, Columbia University Press, 1943. Price \$2.50.

This is an excellent book on this subject. It covers most of the important aspects and is quite readable. For most ophthalmologists it will contain information that will be valuable and is not readily available to them.

The volume is divided into four parts. I. Ten pages about the historical background. II. This, the longest chapter, is on administrative responsibilities. III. Educational responsibilities. IV. Community social service responsibilities. Lastly, appendixes, a comprehensive series of chapters on diverse subjects closely related to the main thesis of the book; such as, Facts about the eye and Eye hy-

giene; Vision testing, a screening process; Outline for checking lighting facilities and equipment for eye work in the classroom. A good bibliography and index complete the work.

As a guide for establishing sight-saving classes this book will serve as a satisfactory outline. The author indicates the different types of classes that are possible in order to meet the varying requirements of diverse communities. Details such as equipment and costs are given. The necessity of coöperation of the ophthalmologists for the success of the program is pointed out.

Lawrence T. Post.

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REMEDIAL TECHNIQUES IN BASIC SCHOOL SUBJECTS. By Grace M. Fernald. Clothbound, 349 pages, with 49 illustrations. New York, McGraw-Hill Book Company, Inc., 1943. Price \$2.75.

This book by Dr. Fernald, associate professor of psychology at the University of California at Los Angeles, has for its objective primarily the report of certain psychologic experiments in the development of skills in the basic school subjects of reading, writing, spelling, and arithmetic. The outstanding contribution is the presentation of the author's methods for overcoming "word-blindness." Her phenomenal success in this field has been well recognized for many years, and doctors and educators alike will welcome this long-awaited compendium of her methods and results.

There are hundreds of thousands of nonreaders and partial reading-disability problems in the elementary schools of this country. The children affected with this condition are usually possessed of normal intelligence and often superior mechanical skill, and should become our finest citizens. Instead they develop seri-

ous negative emotional reactions to school because of constant failure in school work, and finally a definitely antisocial attitude.

The problem becomes of special import at this time, as the majority of cases are found in males possessing the very characteristics needed in war activities, but who, upon application for admission to the Army, are excluded or classified as illiterates. A survey of Dr. Fernald's cases, presented as part VI of this book, reveals that many adults coming to her at 17 and 18 years of age responded almost miraculously to her method of teaching. Her success should be a challenge to educators for early recognition of cases meriting application of remedial technique, and a plea for more extensive training of teachers of remedial reading for children and adults alike.

Every ophthalmologist should read this report, for any child who becomes a reading problem is likely to be referred to an ophthalmologist in hopes of finding some visual defect that may account for inability to learn to read. The ophthalmologist must not feel that his responsibility ends with a declaration that the child's eyes are not a factor in the reading difficulty. He should become sufficiently well acquainted with Dr. Fernald's work to advise the child's parents and teachers as to the seriousness of their negligence if they do not insist on remedial reading for the child, and to instill into the child and the parents absolute confidence that the handicap can be cured.

Instructive to ophthalmologists is Dr. Fernald's discussion of eye conditions that may affect reading skills, and of eye movements in reading. Her conclusions become authoritative by virtue of her clear thinking and her serious consideration in the cases she has studied of any relation between eye conditions and learning. She has found many individuals with

monocular vision, nystagmus, involuntary spastic head-jerking, and so forth, who read with a high degree of speed and comprehension provided the mechanism of the eye is such as to give a clear retinal image.

Dr. Fernald's supreme skill in simplifying material heretofore presented in a complicated and complex manner makes this treatise easily comprehensible and enjoyable reading, and thereby of incalculable value.

For instance, her description of her method of teaching reading is so clearly and concisely reviewed as to be apprehended by every interested teacher and the average parent.

Dr. Fernald says: "All authorities agree that the causes of reading disability are numerous and vary from case to case. Certainly our results with both children and adults suggest that no one specific disorder is responsible for the seeming inability of some individuals to read. Such conditions as poor vision or hearing, illness, or other physical disabilities, poor homes, poor schools or other unfavorable environmental conditions, extreme emotional instability, mental deficiency, or other mental maladjustments have long been recognized as responsible for reading failures. In most of these cases, individual work and correction of the faulty condition result in normal learning. Many of these cases can be treated successfully in a schoolroom by the use of accepted techniques, provided the child is given special attention in a small group with a strong teacher. After we have eliminated all cases due to the foregoing conditions, we still have a residue made up of individuals who fail to learn under the most careful instruction by methods that are successful with the average child."

She then discusses the techniques found successful in treating such cases.

The general plan of procedure in teaching these children to read is, first, to tell the child that many bright people have had the same difficulty he has and have learned to read by a new method which he may try. He selects any word he wants to learn. It is written for him with crayola on paper in plain blackboard-size script or print. The child traces the word with finger contact. This kinesthetic approach is the key to the situation. Learning is much more rapid when the word is traced with finger contact than when a pencil is used. The child says each part of the word as he traces it, repeating the tracing process until he can write the word without looking at the copy. As soon as the child realizes he can learn to write words, he starts "story writing." In extreme cases the child must learn by the tracing method every word to be used in his story. He asks for any words he wishes to use, learns them, and writes his story. After a story has been written it is typed for the child and he reads it in print. The child files away in his alphabetical word file the words he has learned and used.

After a variable period of tracing the child develops ability to learn new words easily without tracing. His stories become longer and more complicated. They are always typed for him and read by him. Soon he can learn from the printed word by looking at it and saying it before writing it. He recognizes difficult words after once writing them. He begins to want to read books. He is told words he does not know and writes them to learn them. Soon he makes out new words from their resemblance to words he already knows. Then he is eager to read, and delights in his ability to recognize new words without being told what they are.

Dr. Fernald's remedial technique for Mirror Writing is simply to start the child at the left edge of the page, so that the only direction in which his hand can

move with the pencil on the paper is left to right. If the child is left-handed she says, "You write with your left hand. Always start at the edge of the page on the same side as your hand." If the child is right-handed she says, "You are right-handed. Always start on the edge of the page on the opposite side from your hand." The child soon becomes accustomed to placing his pencil at the left edge of the page. He has no difficulty in reversing his inverted writing after establishing the initial position, and the mirror writing disappears within a few days.

individual child, all children could achieve up to their mental age level in all school subjects. It is largely for this reason that I believe this book is one of the most significant contributions ever made to experimental pedagogy."

S. Rodman Irvine.

## OBITUARY

ADOLPH O. PFINGST

1869-1944

Dr. Adolph O. Pfingst was born in Louisville, September 8, 1869. After

Dr. Fernald has been equally ingenious in her analysis of difficulties in spelling and mathematics, and in devising ways of overcoming these difficulties. We cannot expect every teacher, even heeding scrupulously Dr. Fernald's suggestions and admonitions, to be as skillful as Dr. Fernald in handling these problems, but an attempt at understanding and applying her remedial techniques should be demanded of every individual responsible for the training of children in basic school subjects, for Dr. Fernald presents convincing proof that all difficulties in learning to read, spell, write, or figure, in a child of normal or superior intelligence, can be removed or compensated for if the proper technique is employed. An important influence in the direction of solution of this great problem may come from the ophthalmologists' interest and advice to the parents and teachers of these children.

To quote in conclusion from the Foreword by Prof. Lewis Terman of Stanford University: "Perhaps the most important conclusion to be drawn from the extensive researches here reported is that disability of any degree in any of the basic school subjects is wholly preventable. If educational methods were more intelligently adapted to the idiosyncrasies of the

graduating from high school in Louisville and securing a B.A. from the University of Louisville, he entered the medical de-



Adolph O. Pfingst

partment, from which he obtained his medical degree in 1891. Competitive examination awarded him the appointment of resident in the Louisville City Hospital, where he spent a year in rotating service. He then filled an unexpired term on the surgical staff of Mt. Sinai Hospital, New York, before going to Europe to take up the study of ophthalmology.

After a year of work in the laboratories at Marburg, pursuing the study of pathology under Professor Marchand and bacteriology under Prof. Carl Fraenkel, he began his studies in ophthalmology under Professors Uthoff and Axenfeld. In 1893-1894 he was assistant to Professor Schweiger in the University Eye Clinic in Berlin. While there he wrote his thesis and obtained a "Doctor of Medicine" from the University of Berlin.

In 1895, Dr. Pfingst became assistant to Prof. Herman Knapp and house-surgeon to the New York Ophthalmic Institute for a year. He then established himself in Louisville, Kentucky, as an ophthalmologist and associated himself with bacteriologic and histologic laboratories. He established a reputation as a dynamic instructor and was popular with the student body. In 1906, he was promoted to the chair of Professor of Ophthalmology and Director of the Eye Clinic at the Louisville City Hospital. He retired from active teaching in 1938, when the title of Professor Emeritus was conferred upon him.

Dr. Pfingst was a fellow of the American College of Surgeons and was also a member of the American Ophthalmological Society; the Academy of Ophthalmology, Otology, and Laryngology; member of the International Society of Ophthalmology and the Pan-American Congress of Ophthalmology. He also held membership in the American and Southern Medical Associations, the Kentucky

State and Jefferson County Medical Societies, and was active in various medical clubs in Louisville. He was instrumental in organizing the Kentucky State and the Louisville Eye and Ear Societies, each of which he served as president.

Dr. Pfingst was always interested in civic affairs of his home town and was organizer of the first sight-saving class in Louisville; he was active in the national movements for the prevention of blindness.

He contributed to scientific medical literature, his interest being especially centered on pathologic studies of the eye and on diseases and anomalies of intracranial blood vessels.

Since 1930 Dr. Pfingst has had Dr. C. Dwight Townes associated with him in his surgical and office work.

Dr. Pfingst had one daughter, Katherine, who died in 1918. He is survived by his wife, Mrs. Lula Pfingst.

Irwin Abell.

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## CORRESPONDENCE

### 1944 MEETING OF THE LOS ANGELES RESEARCH STUDY CLUB

Editor, American Journal of Ophthalmology:

The thirteenth annual Post-Graduate Clinical Course of the Research Study Club of Los Angeles was held January 17th to 29th. Registrants for the course numbered 311, among them 52 service men; 31 states were represented.

The visiting teaching staff for ophthalmology included Dr. James Watson White, who gave the principal lectures of the Eye Course on "Motor anomalies"; Dr. Georgiana Dvorak Theobald, who reviewed certain aspects of "Eye pathology"; Dr. Meyer Wiener and Dr. Frederick Carl Cordes, who gave instructions and demonstrations on "Surgery of the

eye"; Dr. George Hosford, who assisted Dr. White in the instruction courses, demonstrating muscle cases; and Mr. Irving Lueck of Bausch and Lomb Company, who lectured on "Optics of ophthalmic lenses," "Cross cylinders," "Lighting and colored lenses," and "Selection of bifocals." The main otolaryngologic speakers were Dr. Isidore Friesner, Dr. Gordon B. New, Dr. Arthur W. Proetz, Dr. Samuel Salinger, and Dr. Carl H. McCaskey.

Again this year, following the John Finch Barnhill tradition, a course in "Applied anatomy and cadaver surgery of the head and neck" followed the regular course, January 28th to February 1st.

The large attendance, in spite of wartime inconveniences, justified the attitude of the Research Study Club that postgraduate teaching should be continued during the war years as a means of insuring the best possible medical protection to the country.

It is hoped that the lectures of the principal speakers will be available for publication in the Journal.

Dr. White's course brought to the Research Study Club the Duane school of thought on ocular muscles. In some respects this differs from Bielschowsky's teachings, which were presented in this course in 1938. Combining the ideas from both these authorities will lead to a broader understanding of muscle problems. Dr. White emphasized the use of the cover test and the screen comitance test. He does not rely upon the measurement of diplopia for diagnosis, as did Bielschowsky, but instead neutralizes with prisms the movement of the eyes brought out by the cover test in the six cardinal positions. No one is as responsible for popularizing this objective method for measuring eye deviations as is Dr. White. In addition he has simplified recording of these deviations, so that muscle tests are not so com-

plicated nor time-consuming as previously.

Dr. White does not rely on the head-tilting test to differentiate oblique from vertical recti involvement, as did Bielschowsky. His explanation of double hyperphoria as being involvement of corresponding vertical muscles in the two eyes, differs from that of Bielschowsky, who considers this phenomenon as supranuclear innervational disorder. This disparity in ideas relative to use of the head tilt in diagnosis of oblique abnormalities, and the origin of double hyperphoria, offer fields for confirmatory investigation.

As the various types of anomalies were discussed, with their infinite variations, the lecturer's intimate personal contact with the solution of muscle problems was appreciated by those in attendance in proportion to their experience in muscle work. It was extremely instructive to hear Dr. White discuss specific cases such as have worried all of us as one who has encountered the problem many times and considered and treated it from varied points of view. In summary, the course stressed the practical side of muscle work. Consequently the sensory aspect of motor anomalies, as abnormal retinal correspondence, inhibition, and amblyopia, were but briefly touched upon.

In the reviewer's opinion the outstanding lectures by Dr. Theobald were those on the "Anatomy and histology of the anterior segment of the eyeball with reference to the canal of Schlemm," on "Eye infections," and on "Intraocular tumors." Dr. Theobald demonstrated her serial sections, showing direct communications from the anterior chamber through the canal of Schlemm to the vascular system about the extraocular muscles.

Her discussion of the use of calcium gluconate in eye infections was new to many of us and will add to our therapeutic armamentarium.



Her classification of intraocular tumors as to malignancy will be of definite benefit to members of the Course in decisions as to the prognosis in and treatment of such cases.

Dr. Wiener and Dr. Cordes demonstrated, along with other operative procedures, Dr. Wiener's operation of forming a union between the levator and superior-rectus muscles for correction of ptosis.

Mr. Irving Lueck's interesting lectures on optics were extremely practical, easily

understandable, and are available in reprint form.

This annual Course is unique in that it is designed to attract the general eye, ear, nose, and throat practitioner who is seeking a solution to his everyday problems, as well as the academic-minded specialist to whom it affords an opportunity to meet world-known authorities and discuss with them, through the arrangement of courses and entertainment, the particular interests or problems he has in mind.

S. Rodman Irvine.

## THE FORM AND CHARACTER OF ROD SCOTOMETRY

AIR COMMODORE P. C. LIVINGSTON

(Concluded from page 353)

early stage in vitamin-A deficiency (fig. 5). This condition has been recorded while the subject continues to provide a normal adaptometer curve. This divergent result seems explainable on the grounds that while with the adaptometer a selected patch of retina is subjected to the test, with a screen a wide area is examined by means of a moving target. The question of movement which increases the spread of the threshold visual sensation must be regarded as of significance.

*Pathologic features.* It will suffice to illustrate the field appearances of one pathologic condition (fig. 6). In cases of diabetes, small lozenge-shaped scotomata appear, dotted irregularly about the field. This is accentuated under states of reduced-oxygen tension. There appears to be a close association between the scat-

tered areas of deficiency revealed on the screen and the nutritional disturbances in the retina that are brought about through capillary embarrassment.

### SUMMARY

Scotometry, employing self-luminous test objects and a red fixation light, appears to reveal defects in the central field of vision which cannot readily be found by customary procedures. It is well to confine this method to the 30-degree screen. Up to this point, it is possible to work with very low luminosities, such as  $4 \times 10^{-9}$  or  $6 \times 10^{-9}$  candle power, without introducing physiologic effects likely to be confused with early pathologic conditions. Further work is being undertaken to improve equipment and technique, so as to establish normal field characteristics.

R.A.F. Kelvin House, Cleveland Street.

# ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

## CLASSIFICATION

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| 1. General methods of diagnosis                        | 10. Retina and vitreous                                |
| 2. Therapeutics and operations                         | 11. Optic nerve and toxic amblyopias                   |
| 3. Physiologic optics, refraction, and color vision    | 12. Visual tracts and centers                          |
| 4. Ocular movements                                    | 13. Eyeball and orbit                                  |
| 5. Conjunctiva   | 14. Eyelids and lacrimal apparatus                     |
| 6. Cornea and sclera                                   | 15. Tumors   |
| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries   |
| 8. Glaucoma and ocular tension                         | 17. Systemic diseases and parasites                    |
| 9. Crystalline lens                                    | 18. Hygiene, sociology, education, and history         |
|  | 19. Anatomy, embryology, and comparative ophthalmology |

### 1

#### GENERAL METHODS OF DIAGNOSIS

Kronfeld, P. C., and McGarry, H. I. **Present limits of gonioscopy.** *Amer. Jour. Ophth.*, 1944, v. 27, Feb., pp. 147-153. (One table, references.)

Pitman, L. K. **A combined ophthalmoscope and retinoscope.** *Arch. of Ophth.*, 1943, v. 30, Nov., pp. 667-668.

The author describes the construction of an instrument that can be used as either an ophthalmoscope or a retinoscope. (One illustration.)

R. W. Danielson.

### 2

#### THERAPEUTICS AND OPERATIONS

Arjona, J. **Subconjunctival auto-hemotherapy.** *Arch. de la Soc. Oft. Hisp.-Amer.*, 1942, v. 1, Aug., pp. 140-155.

One c.c. of blood taken from a vein in the patient's arm is injected beneath the bulbar conjunctiva in various allergic and inflammatory affections of the eye. The blood is absorbed within 6 to 15 days. Several injections may be necessary. Beside the curative effect

the striking relief of pain is an important benefit. The injections have been found very efficacious in tuberculous keratitis, trachomatous pannus, rheumatic iritis, scrofulous keratoconjunctivitis, and reactions of sensitivity to atropine and eserine. In the latter it has been possible to continue the use of atropine or eserine after an injection. Conditions not benefited were hypopyon ulcer, luetic interstitial keratitis, and tuberculous, traumatic, or postoperative iritis. With the blood injected locally, the author argues that the circulating antibodies are brought to bear directly on the eye.

J. Wesley McKinney.

Atkinson, W. S. **Local anesthesia in ophthalmology.** *Arch. of Ophth.*, 1943, v. 30, Dec., pp. 777-808.

The history of the use of local anesthetics in ophthalmology is reviewed. General conditions affecting anesthesia are discussed, including the distribution of sensory nerves to the orbit and the mental attitude of the patient and surgeon. After describing the various local anesthetic agents, the author concludes that tetracaine is the best drug

for surface instillation and that procaine is the most suitable for injection. The effect of procaine injection is improved by the addition of epinephrine.

Detailed directions are given for the production of intradermal wheal, nerve block, and field block. Retrobulbar injection into the muscle cone, block of the infraorbital nerve, block of the infratrochlear nerve, facial akinesia, and so forth are explained. The appropriate methods of anesthesia for the commoner ophthalmic operations are described. Techniques are described in such detail and with such a practical approach that the article should be of value even to ophthalmic surgeons of long experience. (16 illustrations, bibliography.)

John C. Long.

Bieltiukova, A. A. Roentgen therapy of some ocular diseases. *Viestnik Oft.*, 1943, v. 22, pt. 2, pp. 35-40.

A review of the literature, and a report of the author's clinical investigations on 45 patients. Roentgen therapy was found very effective in chronic tuberculosis of the anterior ocular segment. The initial dose was 10 to 20 percent of the erythema dose, and three or four treatments were given at intervals of 12 days. An acute reaction lasting several days after the treatment was frequent. In some cases, immediately after the irradiation, there developed around the inflammatory focus transitory gray streaks, radiating from the center toward the periphery. The effects of the treatment included subsidence of inflammatory phenomena, visual improvement, and absence of recurrence. Twenty patients with other diseases were subjected to this form of therapy. It was ineffective in trachoma, in traumatic iridocyclitis, and in leukoma. It checked suppuration in the vitreous in a case of traumatic endoph-

thalmitis, but the eyeball went on to atrophy. In two cases of secondary glaucoma this treatment relieved the pain. A fistula of the lacrimal sac closed after irradiation. Ray K. Daily.

Buxton, R. Anesthetics for ophthalmic operations. *Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, pp. 179-182.

The author insists that the aim of anesthesia is to reduce fear and apprehension to a minimum, and to abolish pain, without incurring risk to the eye or to the patient. Premedication is indicated to lessen apprehension as well as to aid in the effect of the local anesthesia. In cataract operations, facial-nerve block is advised, as well as subconjunctival injection at the points of fixation. In acute glaucoma or acute iritis a pledget of cotton soaked in 5-percent cocaine with adrenalin and placed on the conjunctiva preliminary to the subconjunctival injection has aided anesthesia a great deal. In detachment of the retina the patient should receive extra sedation, and repeated local instillations as may be necessary to continue a painless operation. For dacryocystectomy, careful injection of the infraorbital and infratrochlear nerves is advised.

Beulah Cushman.

García Miranda, A. Alterations of refraction in the course of sulfonamide therapy. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1942, v. 1, Sept., pp. 305-307. (See Section 3, Physiologic optics, refraction, and color vision.)

Green, E. W. The present status of sulfonamides in ophthalmology. *The Mississippi Doctor*, 1943, v. 21, July, p. 35.

In the treatment of bacterial diseases

sulfonamides aid principally by their bacteriostatic action. Following oral administration, the concentration of sulfadiazine in the aqueous seems greater than that of sulfanilamide or sulfathiazole, but the latter increases in the presence of ocular infection. Sulfonamides are excreted by the kidneys, sulfapyridine in its acetylated form being responsible for renal calculi. Toxic effects vary from cyanosis and gastric upsets to fever, rash and leukopenia.

Oral sulfonamides are employed by the author in severe cases of acute conjunctivitis. They have unquestioned value in gonorrheal conjunctivitis, but their exact role in trachoma is somewhat in dispute, with most observers agreeing that there is clinical improvement. Favorable results have been obtained in inclusion conjunctivitis, blepharitis, corneal ulcer, and cellulitis of lids and orbit. The merit of these drugs in other ocular diseases has not been so clearly demonstrated.

Benjamin Milder.

Kravitz, D., and Duest, L. J. Post-operative endogenous infection of the eye with recovery. *Amer. Jour. Ophth.*, 1944, v. 27, Feb., pp. 167-171. (References.)

Marin Amat, M. Mercurochrome in ophthalmology. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1942, v. 1, Aug., pp. 156-162.

A glorification of mercurochrome as a specific preventive and cure for all suppuration infections of the conjunctiva and cornea.

J. Wesley McKinney.

Marin Amat, M. The sulfonamides in ophthalmology. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1942, v. 1, Sept., pp. 297-304.

This is a review of the use of the sulfonamides in several ophthalmologic conditions.

Potter, W. B. Visual impairment during tryparsamide therapy. *Arch. of Ophth.*, 1943, v. 30, Nov., pp. 669-687. (See Section 11, Optic nerve and toxic amblyopias.)

Stewart, R. A. The use of naphthocaine as a local anesthetic in ophthalmology. *Amer. Jour. Ophth.*, 1944, v. 27, Feb., pp. 178-179. (References.)

### 3

#### PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Allen, M., Flack, F., and Billings, M. L. Three pedigrees of eye defects. (Nystagmus and myopia.) *Jour. of Heredity*, 1942, v. 33, Dec., p. 453. (See Section 17, Systemic diseases and parasites.)

Argañaraz, R. Chromatoscopic case for the diagnosis of color blindness. *Arch. de Oft. de Buenos Aires*, 1942, v. 17, May, p. 247.

To overcome the inadequacy of the Holmgren and Edridge-Green color tests, and to avoid the patient's memorizing the Stilling-Ishihara plates for the detection of color blindness, the author presents a chromatoscopic case of his own design. It consists of a box with two holes, the borders of which are painted with pure spectral red and green. There are twenty-four beads giving different hues of red and green and also confusion colors. During the test the patient drops the beads through the holes of matching color, and the results can be quickly observed by examining the beads fallen in the compartments under the two respective holes. (Color illustration.) Plinio Montalván.

Burian, H. M. Influence of prolonged wearing of meridional size lenses on spatial localization. *Arch. of Ophth.*, 1943, v. 30, Nov., pp. 645-666.

When a meridional size lens is placed with its axis at 90 degrees in front of one eye of a normal observer, the retinal image of that eye is enlarged in the horizontal meridian. Since horizontal disparity of the retinal images is responsible for stereoscopic effects, the observer will experience typical changes in the appearance of his environment. The author planned the present work to answer the following questions: What happens to the appearance of space and to an observer's functioning within space when a meridional size lens is worn constantly for a certain length of time? Do the spatial distortions of the normal surroundings remain unchanged? Does the rotation of the horopter curve remain the same? Does the capacity of compensating for artificially introduced meridional aniseikonic errors exist?

Experiments are reported in which three observers wore a meridional size lens at axis 90 degrees in front of one eye for 8 to 14 days. After a technical discussion of the data, the author concludes in part as follows:

When a person with normal binocular vision places a meridional size lens at axis 90 in front of one eye and wears this lens for several days, he at first experiences a typical distortion of his surroundings. The longer the lens is worn, the less the distortion is noticeable, and it finally disappears and is absent as long as the observer remains within roundings abounding in perspective and other uniocular elements.

However, if the number of effective perspective factors in the surroundings is negligible, the distortion recurs immediately, and measurements made

with instruments from whose field of view these factors are absent show that the larger part of the image size-difference is still present, no matter how long the size lens has been worn. But there is an average decrease in the effectiveness of the size lens of from one fifth to two thirds as measured with these instruments. This decrease in effectiveness could be due either to a process of actual physiologic compensation, leading to a redistribution of the stimuli on the retinas, or to a psychologic reinterpretation of the relation of objects in space under the influence of uniocular clues in the surroundings and of memory values of past experience. (10 figures, 5 tables, references.)

R. W. Danielson.

Butler, T. H. Forty-eight years of refraction. *Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, pp. 247-255.

The author emphasizes that the object of refraction is to make the patient comfortable, not to solve a problem in optics, yet he also states that an infant with poor acuity will probably become unobservant and develop unsocial habits.

Some of the difficulties brought out relate to the necessity of examining the macular area to get the proper reading in the retinoscopic examination, the danger of insufficiency of cycloplegia when this is used, and the necessity of checking the binocular vision with the correction and adjusting accordingly for the final prescription. (One graph.)

Beulah Cushman.

Cotlier, I. Applications of the stenopaic slit in refraction. *Arch. de Oft. de Buenos Aires*, 1942, v. 17, May, p. 266.

The author discusses at length the optical principles of the stenopaic slit,

which he finds of practical value in measuring the refractive error and in determining whether an ametropic eye has been accurately corrected with lenses. (Diagrams, bibliography.)

Plinio Montalván.

Cotlier, I. The velonoskiascope. Rev. Oto-Neuro-Oft., 1942, v. 17, Jan.-Feb., pp. 13-21.

This instrument of refraction, not in general use in this country, is based on the observations of Holth, who noted that when a needle was slowly moved before an ametropic eye which was fixing a light at 5 meters, a shadow formed whose movement depended upon the type of refractive error present in the examined eye. The shadow takes the form of the needle, and does not exist in an emmetropic eye. If the eye is hypermetropic and uncorrected, the movement of the shadow is against the movement of the needle; the opposite is true of myopia. In simple astigmatism a shadow exists only in the axis of the astigmatism and may be removed by placing a correcting cylinder before the eye. In cases of compound astigmatism and mixed astigmatism, corresponding findings obtain with regard to the movement of the shadow—against in hyperopia and with in myopia.

Instead of Holth's primitive apparatus, the author has devised a compact instrument, the velonoskiascope (from the Greek word for a needle), which consists of a stand, a round, revolvable disc with meridian-finders, and a central illuminated slit covered with milk glass. With this instrument and trial lenses he can determine both spheric and cylindric corrections. One of the disadvantages of the apparatus is that it requires a high degree of coöperation by the patient. However, it has the ad-

vantage of minimizing any error due to an examiner's possible inexperience, of utilizing macular vision, and of being more refined than the simple skiascope, especially in cases of scissors movement, miosis, and small corneal or lenticular opacities.

Edward Saskin.

Crozier, W. J., and Wolf, E. Theory and measurement of visual mechanisms. 9. Flicker relations within the fovea. Jour. Gen. Physiology, 1943, v. 27, Nov., pp. 119-138.

The investigation described in this highly technical article aims to determine flicker recognition contours within the human fovea with reference to light-time fraction ( $t_L$ ) and wavelength composition as controlled parameters, and also considers the areas and form of the test patch. It deals further with conclusions arising from the study of reasonably homogeneous data on flicker recognition as a function of flash frequency and flash cycle form, flash intensity, image area and form, retinal location, wavelength composition of the light, and the fraction of the cycle-time occupied by light.

The authors state that "white" must be regarded as a synthesis, not a mere summation, of effects due to different spectral regions. Attention is called to certain differences between foveal and more peripheral regions tested, and as between observers differing in the degree of the "yellow spot effect," with regard to the relative effects of wavelength and of image area.

W. H. Crisp.

Dunlap, Knight. Mental maladjustment and color vision. Science, 1943, v. 98, Nov. 26, p. 470.

Since a number of cases of parachromopsia (so-called "color-blindness")

were found among persons who gave a history of dietary insufficiency, especially lack of meat in the diet, and since neurotic stammerers are (according to the author) usually not meat eaters, the author was interested in testing the color vision of persons suffering from neurotic maladjustment. Twelve neurotics were selected for the color-vision test. The Ishihara charts and Lohen's revision of the Nela tests were used. Of the 12 only one was found to have completely normal color vision.

The author further criticizes the present method of color-vision examination at close range, whereas the practical requirements call for recognition of color at a great distance. The author, moreover, postulates that color vision should in general be tested under conditions similar to those in which the colors are used. R. Grunfeld.

Gamble, R. C. High congenital myopia, with convergent strabismus. *Amer. Jour. Ophth.*, 1944, v. 27, Feb., pp. 159-160.

García Miranda, A. Alterations of refraction in the course of sulfonamide therapy. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1942, v. 1, Sept., pp. 305-307.

A 26-year-old man was given 22 grams of the sulfonamide "uliron" over a period of 17 days. After 24 hours his vision became suddenly blurred, being reduced to O.D. 1/6 and O.S. 1/8. The corneal astigmatism was 0.5 diopter each eye, as measured by the ophthalmometer, and remained the same for the duration of the disturbance. Refraction revealed O.D. -2.00 sph. -2.00 cyl. ax. 60° = 1.0, and O.S. -2.00 sph. -2.00 cyl. ax. 120° = 1.0, unchanged by repeated instillation of atropine. Administration of uliron was discontinued and within four days the

vision was 1.0 each eye without correction. The disturbance apparently resulted from absorption of the sulfonamide by the lens.

J. Wesley McKinney.

Lister, A., and Bishop, J. W. Night vision in the Army. *Brit. Med. Jour.*, 1943, Sept. 11, p. 325.

The results of 10,333 tests for night vision on high-category men between the ages of 18 and 55 years are tabulated. Though the test is one of form sense, it appears that the minimum light necessary for discrimination of a simple form is in the region of the absolute light threshold. Classification illustrates the downward trend of scotopic vision which occurs with advancing years. This point is more of theoretic interest since the drop from the average at 18 to that at about 44 years is only in the region of 3 micromillilamberts.

Owen C. Dickson.

Luckiesh, M., and Taylor, A. H. Visual acuity at low brightness-levels. *Amer. Jour. Ophth.*, 1944, v. 27, Jan., pp. 53-57. (2 figures, references.)

McFarland, R. A., Hurvich, L. M., and Halperin, M. H. The effect of oxygen deprivation on the relation between stimulus intensity and the latency of visual afterimages. *Amer. Jour. Physiology*, 1943, v. 140, Dec., pp. 354-366.

The relationship between the latency of visual afterimages and stimulus intensity during exposure to various atmospheric oxygen tensions is shown in tabulated form. These data are based on six experimental sessions employing three trained subjects. Each session consisted of a series of measurements in normal air followed by repetitions during anoxia; and finally 100 percent



oxygen was administered and observations repeated after recovery intervals.

The conclusions reached are that the effect of oxygen deficiency on the latent time of the "tertiary" visual afterimage, measured in a low oxygen chamber over a wide range of stimulus intensities, shows that in normal air there is an inverse relationship between the latent time of the afterimage and the intensity of the stimulus, reduction of the intensity of the stimulus prolonging the latency of the afterimage. Anoxia prolongs the latency of the afterimage. Complete recovery of the latent time upon administration of oxygen may require up to fifty minutes and the apparent brightness of the visual field is restored to normal within three to four minutes. The behavior of the visual mechanism is believed to reflect changes in the central nervous system, since the retina is embryologically a part of the central nervous system and resembles it metabolically and anatomically. Slowness of recovery of the function is therefore indicative of a similar delay in the recovery of other central nervous functions. This emphasizes the importance of the use of oxygen by airplane personnel at high altitudes as a preventive measure, before any appreciable effect of anoxia occurs. The possibility that some central nervous functions recover slowly after anoxia suggests that certain factors contributing to landing accidents at sea level after high altitude flights without an adequate oxygen supply may be attributed to the residual effects of lack of oxygen. Melchior Lombardo.

Miles, W. R. Color blindness in eleven thousand museum visitors. *Yale Jour. Biol. and Med.*, 1943, v. 16, Oct., p. 59.

By Ishihara charts, 7.1 percent of eight thousand men were found defective in color vision, and 1.3 percent of three thousand women were similarly defective.

Six grades of color defect were proposed, arranged in order of diminishing defect from group I to group VI. Group IV includes typical dichromates and extreme anomalous trichromates. The author suggests that groups I to IV ought to be disqualified for service with the air force, whereas groups V and VI should be relatively safe risks. Groups I and II are entirely unsafe where recognition of colored signals is important. The author states that pseudo-isochromatic charts presenting colored forms of the vanishing pattern type on neutral gray backgrounds of similar brightness constitute a rapid practical means for determining degrees of color defect.

Robert N. Shaffer.

Obrig, T. E. A new ophthalmic impression material. *Arch. of Ophth.*, 1943, v. 30, Nov., pp. 626-630.

The satisfactory fitting of contact lenses became a possibility when it was discovered that molds of the living human eye could be made with negocoll. However, negocoll has certain disadvantages and the present paper deals with the author's experience with a new medium called moldite powder—for which the manufacturer refuses to divulge the formula. It is an alginate gelling agent which reacts when mixed with distilled water. The gelling is retarded by a preparation which gives sufficient time for the material to be placed on the eye and the molding shell centered before the gelling takes place.

The many advantages of moldite

powder over negocoll are well outlined and the technique of its use is given in orderly and meticulous detail. (2 figures.)

R. W. Danielson.

Orton, S. T. Visual functions in strephosymbolia. *Arch. of Ophth.*, 1943, v. 30, Dec., pp. 707-711. (See Section 12, Visual tracts and centers.)

Pascal, J. I. A new approach to cross-cylinder tests. *New York State Jour. Med.*, 1943, v. 43, Feb. 15, p. 323.

For every astigmatic eye in a state of rest, one spherical lens gives better visual acuity than any other spherical correction. This "spherical equivalent" represents that correction in which Sturm's conoid straddles the plane of the retina so that a round diffusion circle is focused on the retina—a state of equally mixed astigmatism.

If an eye is so corrected that it is placed in such a state of equally mixed astigmatism as mentioned above, then the cross cylinder may be used to best advantage in determining the presence of, and axis of, astigmatism. In such a condition, the patient appreciates differences in the two positions of the cross cylinder by differences in the size of the diffusion circles.

One table in the paper illustrates the fact that the difference in size of diffusion circles is greater, the stronger the cross cylinder used (providing it is held so that one axis of the cross cylinder is at or very near the axis of astigmatism), until one reaches a cross cylinder equal in cylinder strength to the existing astigmatism. Under these conditions, there will be a maximum diffusion circle in one position, and none at all in the other position. Thus one should use a stronger cross cylinder. The difference in size of circles de-

creases as the cylinder axes become more obliquely inclined to the axis of astigmatism, until at 45 degrees to the astigmatic axis there is no difference.

Using this same "spherical" approach for determining the axis of astigmatism, the best effect is obtained by the use of correcting cross cylinders, as well as the testing cross cylinder. As the cylinder strength increases (both correcting and testing), the difference in size of diffusion circles increases. One table shows the results obtained with a fixed combination of 0.25 correcting cross cylinder and 0.50 testing cross cylinder. This combination proves to be satisfactory in most cases. Within 5 or 10 degrees, however, a more exact method would be the use of a testing cross cylinder half the strength of the correcting one. This step may be used, as a final check on the axis, after the cylinder strength has been determined.

For determining the amount of astigmatism, a stronger cross cylinder is preferable, in early stages of the test, utilizing correcting cross cylinders to maintain the same spherical equivalent.

Benjamin Milder.

Pember, A. H. Presbyopic analysis. *Dis. Eye, Ear, Nose, and Throat*, 1942, v. 2, Dec., p. 364.

In addition to a proper refraction, measurement of accommodation convergence and interpupillary distance is considered of great importance in giving comfort to wearers of presbyopic corrections. Methods used in these determinations, other than the actual refraction of the patient, are described. The prismatic effect of certain lenses is discussed briefly.

Most refractionists are said to overcorrect their patients for near use. The author discusses a modification of the

use of the ampliometer with reference to additions for near use of the eyes.

F.-M. Crage.

Pett, L. B. Riboflavin and vitamin A in relation to "eye strain". Canadian Med. Assoc. Jour., 1943, v. 49, Oct., pp. 293-295.

A three-months study was made on 232 men and women whose vocation was reading handwriting under normal lighting conditions and who complained of "eye strain." The ages varied from 20 to 70 years. Conjunctival opacities as seen with the biomicroscope constituted apparently the sole evidence of vitamin-A deficiency, and blood vessels crossing the limbus between the 5 and 7 o'clock positions were the sole evidence of riboflavin deficiency. The large group was divided into three equal small groups. One group received a capsule of 10,000 i.u. of vitamin A daily; the second, 3 mg. of riboflavin daily; the third, a capsule containing inert matter. The patients did not know the nature of their medication. In no case was the diet supposed to be changed. In the vitamin-A series, as judged by the above biomicroscopic criteria, 12 percent of those with deficiencies improved after three months of 10,000 i.u. of vitamin A daily. In the riboflavin series, 57 percent of those with deficiencies improved after treatment, but 47 percent improved without any treatment. Charles A. Bahn.

Prado, Durval. Concerning Márquez' biastigmatism. Arquivos Brasileiros de Oftalmologia, 1943, v. 6, June, pp. 100-104.

The author briefly indicates the nature of Márquez' technique. The astigmatic test is begun by measuring the corneal astigmatism with the ophthalmometer and then using skiascopy and

subjective tests to measure separately the "residual astigmatism." The author remarks that many ophthalmologists have convinced themselves of the necessity for prescribing one-eighth diopter intervals, whereas some large manufacturers of correcting lenses do not make lenses having such intervals.

W. H. Crisp.

Salvatori, P. L., and Oriani, A. The fitting of contact lenses. Arch. of Ophth., 1943, v. 30, Dec., pp. 763-766.

Molded plastic contact-lenses must often be adjusted to fit the individual eye. The authors have worked out a method of making these adjustments according to plan. In the fitting of contact lenses, one must bear in mind the convergence of the eyes, the pressure of the lids, and the effect of gravity. To compensate for these factors, a contact lens should be fitted so that the corneal portion will be decentered upward and turned slightly toward the nose. When fitted correctly the lens should rest uniformly on the sclera without constricting the blood vessels. There should be no tight or loose areas.

The contact lens is first checked for over-all size. Instructions are given for trimming away the margins if they exceed the fairly definite size limitations. Rotation is studied after marking the lens with a horizontal line, and is controlled by relieving excessively tight areas or by tightening loose edges. Tight or loose areas are detected by instilling fluorescein and suitable correction is obtained by grinding with a grit-impregnated rubber point on a dental machine. Optical centering is determined after marking the pupillary center on the plastic while the lens is in the eye. A blue-print-like record of the corrective markings is made in every case. This is an indispensable aid

to the fitter, serving as a permanent record and as a basis for planning necessary adjustments. Much time is saved and a more comfortable fit is obtained by following a definite plan rather than by free trial-and-error methods. (2 color plates.)

John C. Long.

#### 4

### OCULAR MOVEMENTS

Allen, M., Flack, F., and Billings, M. L. Three pedigrees of eye defects. (Nystagmus and myopia.) *Jour. of Heredity*, 1942, v. 33, Dec., p. 453. (See Section 17, Systemic diseases and parasites.)

Argañaraz, Raul. Nystagmus. Conjugate deviations of paralyses of the conjugate movements in diseases of the brain. *Arch. de Oft. de Buenos Aires*, 1942, v. 17, March, p. 113.

The author reviews the anatomic basis and the mechanism of the production of nystagmus, of conjugate deviations and of paralyses of the conjugate movements of the eyes; discussing their diagnostic significance. The literature on the subject is also reviewed. (Bibliography.)

Plinio Montalván.

Argañaraz, Raul. Study of optokinetic nystagmus as a means of diagnosis. *Arch. de Oft. de Buenos Aires*, 1942, v. 17, June, p. 323.

The mechanism of optokinetic nystagmus is discussed and its diagnostic value is emphasized. It is abolished in lesions of the oculomotor centers and pathways, and in the optic tracts and visual cortex. Plinio Montalván.

Burri, Clara. The use of prisms in orthoptics. *Amer. Jour. Ophth.*, 1944, v. 27, Jan., pp. 61-66. (References.)

Dolph, C. H. The cover test as an aid to diagnosis in extraocular muscular anomalies. *Texas State Jour. Med.*, 1943, v. 38, Feb., p. 612.

Dolph calls attention to the cover test. Because of its simplicity it is often neglected. T. M. Shapira.

Foster, C. B. A new suture for use in muscle-recession operations. *Amer. Jour. Ophth.*, 1944, v. 27, Jan., pp. 71-72.

Gamble, R. C. High congenital myopia with convergent strabismus. *Amer. Jour. Ophth.*, 1944, v. 27, Feb., pp. 159-160.

Grieve, J., and Archibald, D. H. Some facts and figures relating to heterophoria in symptom-free individuals. *Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, pp. 285-293.

The authors report on a study of heterophoria in a selected group of air recruits between the ages of 17½ and 30 years. Out of 7,019 men examined, 53 percent showed lateral, vertical, or both deviations, and only 1.3 percent complained of symptoms. Voluntary convergence was found in 30 percent of 1,268 recruits examined.

The second part of the paper gives results of an investigation into the incidence of convergence insufficiency among normal school children. Of 104 children examined, 8 percent showed heterophoria, and 58 of these children had voluntary convergence. In comparing the development of the child intellectually and emotionally with the above findings, out of 58 children with perfect voluntary convergence 30 were considered normal, 17 intellectually retarded, and 11 unstable. Of the 46 without the power of voluntary convergence 14 were regarded as normal in

all ways, 8 intellectually retarded, and 24 unstable.

The third part of the paper deals with findings in a group of retarded children. Of the 86 examined, 52 did not have full voluntary convergence. Of these, twenty were intellectually retarded and 32 emotionally unstable.

Facts of special interest are the disparity between the number of individuals showing phorias and the number with symptoms, the high incidence of poor voluntary convergence in all groups, and the high incidence of esophoria for distance and of exophoria for near among adults.

Beulah Cushman.

Hermans, T. G. Torsion in persons with no known eye defect. *Amer. Jour. Ophth.*, 1944, v. 27, Feb., pp. 153-158. (One table, 3 figures, references.)

Kobrak, F. Studies on vestibular nystagmus. *Jour. Laryng. and Otol.*, 1943, v. 58, May, p. 167.

The author describes his studies carried on with weak caloric stimulus on the labyrinth in preference to the rotatory test, and he discusses his observations on latent nystagmus. These experiences may serve as a diagnostic aid for detection of abnormalities of the acoustic nerve.

R. Grunfeld.

Krimsky, Emanuel. Fixational corneal light reflexes as an aid in binocular investigation. *Arch. of Ophth.*, 1943, v. 30, Oct., pp. 505-520; also *Trans. Amer. Acad. Ophth. and Otolaryng.*, 1943, 47th mtg., March-April, p. 269.

Ocular deviation and binocular imbalance may be measured in a controlled and graded objective manner by artificial restoration of the corneal light reflexes to their fixation positions. Artificial restoration, or centering, of the

corneal light reflexes may be carried out with prisms, the anglo-meter, the phorometric stereoscope, or the synoptophore.

The amount of deviation in a squint may be measured by the strength of prism required to center the corneal light reflexes. It is not intended that this determination replace the familiar cover test. The observation of the light reflex is also of value in objectively determining the amount of prism convergence and divergence, in measuring heterophoria, in distinguishing a heterophoria from a heterotropia, in measuring squint with severe amblyopia, and in demonstrating malingering. In addition, the fixational corneal light reflexes are helpful in the objective study of the near point of convergence, ocular dominance, primary versus secondary deviation, ocular torticollis versus sternocleidomastoid torticollis, the range of monocular movements, binocular fixation, abnormal retinal correspondence, and pseudostrabismus. (12 figures.)

John C. Long.

Malbrán, Jorge. Paralysis of the inferior rectus muscle. *Arch. de Oft. de Buenos Aires*, 1942, v. 17, May, p. 311.

A 29-year-old woman presented a paralysis of the left inferior rectus muscle following a blunt injury to the orbit. The pupil was dilated and irresponsive to the different stimuli in the affected eye. An atypical torticollis, with the head tilted to the right side, was also present. The author discusses the diagnostic significance of this torticollis and the neural mechanism of the mydriasis, as well as the pupillary response to pharmacodynamic tests. From the use of eserine and pilocarpine, which produced marked miosis in this case, he concludes that the lesion was located behind the ciliary ganglion, and

was probably a traumatic hematoma of the orbit. Myectomy of the paralyzed muscle resulted in disappearance of the torticollis and diplopia. The mydriasis was gradually subsiding. (Photographs, bibliography.)

Plinio Montalván.

Mata, P., and Carrillo, E. A case of Erb-Goldflam disease (myasthenia gravis). *Arch. de la Soc. Oft. Hisp.-Amer.*, 1942, v. 1, Sept., pp. 233-250.

The case reported is that of a 14-year-old girl who for the preceding three years had had a mild ptosis of both upper lids of variable degree associated with transient attacks of diplopia. The ptosis was worse in the evening and after exertion. No other muscles were affected although there was a general asthenia with fatigue after much walking. The myasthenic reaction of Jolly was positive. (This test consists in repeated galvanic stimulation of the affected muscles, which in this syndrome show rapid fatigability to the point of complete absence of response to the electrical stimulation.)

The author points out that in most cases of myasthenia there is a disturbance in the metabolism of lactic acid and creatinin with an increase in both blood and urine. In this case, however, there was no increase in the blood lactic acid. Creatinin was markedly increased in the urine. The symptoms were relieved and controlled by glucococcol. Prostigmin was not available to the authors. J. Wesley McKinney.

Pascal, J. I. Nominal duction and true duction power. *Amer. Jour. Ophth.*, 1944, v. 27, Feb., pp. 179-180.

Prangen, A. D. Surgical treatment of paralysis of the rectus muscles of the eye. *Proc. Staff Meetings Mayo Clinic*, 1943, v. 18, May 19, p. 145.

The author presents a case of bilateral traumatic paralysis of the external recti muscles. Transplantation of the inferior and superior recti, a 13-mm. resection of the external recti, and a 6-mm. recession of the interni were performed. This extensive surgery was well tolerated and resulted in straight eyes, obliteration of the diplopia, and normal excursions. F. M. Crage.

Roth, E. V. Orthoptics for the infant squinter, one to four years old. *Amer. Jour. Ophth.*, 1944, v. 27, Jan., pp. 57-60.

Stewart, D. D. S. A method of evaluation of binocular muscle balance. *Brit. Jour. Ophth.*, 1943, v. 27, Nov., pp. 477-483.

As a part of all routine eye examinations, estimation of the dynamic ocular equilibrium for distance as well as for near is recommended. Two instruments are described to assist in rapid estimations of muscle balance: (1) a pair of 7-D. prisms, bases out, in a hand spectacle-frame; (2) a spring mount with a thin handle to take a single trial lens (a 2-D. prism). The fixation target used consists of a Snellen chart on a black ground with a white diamond-shaped card above the chart and a white ring and a dot on either side of the chart.

Tests for esophoria, exophoria, and hyperphoria are described. No attempt is made to indicate how an examiner may use the information gained from these tests, since every oculist has acquired by experience an opinion on measures likely to relieve symptoms of visual discomfort. It is the author's opinion that we do not yet appreciate the extent to which selected adult patients can be helped by "eye exercises" of the right kind. (3 illustrations.)

Edna M. Reynolds.

Sugar, H. S. Guides in the operative (cosmetic) treatment of nonaccommodative concomitant squint. *Arch. of Ophth.*, 1943, v. 30, Nov., pp. 593-602.

In view of the many variable reports on the amount of correction obtainable by various operative procedures, the author has analyzed 65 operations on the internal and external rectus muscles of male Army personnel, ranging in age from 20 to 49 years. The resection operation used was the Lancaster procedure. The recession operation of Jameson was utilized.

The results cannot be easily abstracted and should be read in full. The average values are fairly consistent. Resection of the internal rectus muscle resulted in more correction than did recession of that muscle. The opposite result was obtained with operation on the external rectus muscle, where recession was generally more effective. Seven-mm. recessions were done in some cases in spite of the fact that it is standard procedure not to do a recession of more than 5 mm. on the internal rectus muscle or of more than 3 mm. on the external rectus muscle.

In convergent-squint cases of the convergence-excess type, recession of the internal rectus muscle should be the primary procedure. For deviations up to 15 prism-diopters, recession of the internal rectus muscle of the deviating eye is recommended. With greater degrees of strabismus, resection of the external rectus muscle should also be done. In the convergence-insufficiency type, for deviations up to 16 prism-diopters resection of the internal rectus muscle of the deviating eye is recommended. For deviations of 16 to 25 prism-diopters resection of both internal rectus muscles or resection of the internal muscle of the deviating eye, and recession of the external rectus

muscle of the same eye, depending on the deviations for distance and near vision, are indicated.

In divergent-squint cases of the divergence-excess type, recession of the external rectus muscle of the deviating eye should be the primary operation. In the divergence-insufficiency type, resection of the internal rectus muscle is then the primary operation. Recommendations are also given for the divergence-excess and divergence-insufficiency types. (5 tables, references.)

R. W. Danielson.

Torres Estrada, Antonio. A new scheme for the diagnosis and recording of paralyses of the extrinsic muscles of the eye. *Bol. del Hosp. Oft. de Ntra. Sra. de la Luz*, 1942, v. 2, Jan.-April, pp. 24-30.

After discussion of the subject, and criticism of other schematic methods of recording, the author reproduces his own elaborate diagram and sets forth a series of rules for recognition of the paralyzed muscle or muscles.

W. H. Crisp.

## 5

### CONJUNCTIVA

Bedell, A. J. Distribution of epidemic keratoconjunctivitis in the United States. *Jour. Amer. Med. Assoc.*, 1943, v. 123, Dec. 25, p. 1101.

Keratoconjunctivitis has not been found to be epidemic throughout the United States. The West Coast and Hawaii have reported more complications and more extensive ocular involvements than other areas. (One figure, discussion.) George H. Stine.

Cogan, D. G., Kinsey, V. E., and Drinker, P. Infrared therapy of flash keratoconjunctivitis. *Jour. Amer. Med.*



Assoc., 1943, v. 123, Dec. 4, p. 883. (See Section 16, Injuries.)

Smart, F. P., Young, C. A., and Phillips, K. The treatment of gonorrheal ophthalmia by diathermy in conjunction with sulfonamides. United States Naval Med. Bull., 1943, v. 41, Nov., pp. 1727-1730.

The authors believe that the superior efficacy of combined general fever therapy and hemotherapy over either alone in the treatment of gonorrheal ophthalmia is no longer debatable. Temperature is not the sole factor in curing these infections, for numerous cases have been cured by temperatures lower than the thermal death-point of the invading organism. Short-wave diathermy ranging from 16 to 30 meters and the ultrashort wave from 6 to 10 meters are used in the Navy. A small pancake coil or drum is employed to produce an electromagnetic field and the ultrashort wave is applied with small condenser-spaced discs. In case of necessity the applications may be given with safety every three hours during the 24-hour day. In the first case reported, long-wave diathermy was repeated every eight hours for three sessions. Sulfa drugs were not used. Improvement was noted after eight hours and recovery was complete.

In the second and third cases 15 grains of sulfathiazole was given every three hours during the 24-hour period, in combination with short-wave electromagnetic treatments lasting 30 minutes every 24 hours for approximately six treatments. Within six hours after the first application, notable subjective and objective improvement was noted. Smears were negative for gonococci after 48 hours, and complete recovery without loss of vision resulted in 12 and 18 days respectively.

Charles A. Bahn.

Sulzman, J. H., and Elliott, C. H., Jr. Powdered sulfathiazole in treatment of conjunctivitis. United States Naval Med. Bull., 1943, v. 41, Sept., pp. 1396-1399.

One hundred and sixty-seven persons (apparently domiciled in naval barracks) who had conjunctival redness from various causes were treated by the authors in two groups. Gonorrheal conjunctivitis was excepted. One hundred and thirty-three received an unstated number of instillations of unstated strengths of argyrol and zinc sulphate, and are reported to have had a seven-day average duration. Forty-four of this group were treated with conjunctival applications of powdered sulfathiazole, administered on an ear spoon and preceded by a 1-percent-potocaine instillation. These had an average duration of only two days. (In trying to understand the astoundingly decreased duration produced by the sulfathiazole powder in such a varied group of cases of conjunctival redness physically and chemically produced, the reviewer wonders how much the discomfort produced by the sulfathiazole stimulated the urge to get well by making the cure more painful than the disease.)

Charles A. Bahn.

Torres Estrada, Antonio. Results obtained in ten years with my personal technique for the surgical treatment of pterygium. Bol. del Hosp. Oft. de Ntra. Sra. de la Luz, 1942, v. 2, Jan.-April, pp. 4-15.

This author insists upon the importance of excising the hypertrophied episcleral tissue. After separation of the head of the pterygium from the cornea, leaving Bowman's membrane perfectly clear, the head of the pterygium is excised, but without disturbing the neighboring attachments of the conjunctiva to the corneal limbus. The

author then dissects the conjunctiva from the underlying episcleral hypertrophy, and completely removes the hypertrophied episcleral tissue down to the sclera. Hemorrhage must be carefully controlled to avoid the risk of a conjunctival hematoma. A vertical cut upward in the conjunctiva and another vertical cut downward form two V-shaped conjunctival flaps, the upper one of which is carried down into the gap on the corneal side of the lower incision, so as to make an N-shaped scar the angles and lines of which are united by as many sutures as are found necessary in the particular case. Without statistical details, the author claims success in about 95 percent of 163 cases operated upon by this method since 1939. (9 illustrations.) W. H. Crisp.

## 6

## CORNEA AND SCLERA

Arruga, H. Notes on corneal grafting from the cadaver. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1942, v. 1, Aug., pp. 163-166.

Arruga discusses a number of problems in connection with corneal transplantation and arrives at the following conclusions: (1) Corneas from cadavers are at least as good as those obtained from the eye enucleated from the living. (2) Although good results have been obtained from eyes preserved for four days, it is logical to expect that the earlier they are used the better the result will be. (3) Heterotransplants always result in opacification. (4) To remain clear, transplants must be placed at least in some part contiguous to relatively normal cornea if nutrition and thus transparency are to be maintained. (5) Post-operative imbibition of tears or aqueous indicates a poor prognosis for the graft. (6) In general the greater the post-operative reaction the greater the

opacification of the graft. (7) Myopia frequently results following keratoplasty. (8) Keratoplasty may be performed in inflammatory conditions as soon as the acute phase has subsided and as soon as it is certain that opacification of the cornea will result. Central corneal ulcers and infiltrations may be excised, and with transplantation the period of disability is much shortened. J. Wesley McKinney.

Bedell, A. J. Distribution of epidemic keratoconjunctivitis in the United States. *Jour. Amer. Med. Assoc.*, 1943, v. 123, Dec. 25, p. 1101. (See Section 5, Conjunctiva.)

Burch, E. P., and Gewirtz, A. J. An ocular complication following mechanical fever-therapy. *Venereal Dis. Information*, 1943, v. 24, Nov., pp. 330-331.

The frequency of superficial punctate keratitis following mechanical fever-therapy combined with sulfathiazole orally in the treatment of chronic gonorrhea led the authors to experiment with local applications of mineral oil as a preventative. In six patients receiving this general treatment, one drop of mineral oil was placed in the left eye every two hours during the eight hours of fever therapy, the right eye being untreated. Although in several cases the condition appeared in the untreated eye, it never occurred in the eye treated with mineral oil. A larger series of 25 cases was then treated with mineral oil in both eyes as above described. In none of these cases was superficial punctate keratitis observed. The authors believe with Neame that the ocular condition is essentially a virus infection which becomes active after lowering of corneal resistance by dryness and high temperature.

Charles A. Bahn.

Buschke, W., Friedenwald, J. S., and Fleischmann, W. Studies on the mitotic activity of the corneal epithelium. *Johns Hopkins Hosp. Bull.*, 1943, v. 73, Sept., p. 143.

The method of obtaining, clearing, staining, and counting fragments of rat cornea to demonstrate mitotic activity of the corneal epithelium is described. Mitotic activity may shed important light on actions of drugs and processes of repair.

Standardization of mitosis counts in normal rats and then following colchicine injection indicates the rate of mitosis. This is possible because of the arrest of mitosis in the metaphase following use of the drug, without influence either on the rate of entrance into mitosis or the velocity of the cycle up to this phase. With this as a basis it was found that ether anesthesia inhibited entrance of corneal epithelial cells into mitosis, and in certain conditions altered the speed of the process.

Locally applied cocaine hydrochloride and ephedrine hydrochloride decrease the entrance of epithelial cells into mitosis. Owen C. Dickson.

Das Gupta, B. K. Parenchymatous keratitis following riboflavin deficiency. *Indian Med. Gaz.*, 1943, v. 78, April, p. 198.

A partially albinotic 30-year-old Hindu male had marked deep keratitis of one eye and other local signs. Vascularization of the cornea of the affected eye was entirely absent. Total clearing of the cornea occurred in 29 days after administration of 100 mg. of lactoflavine administered both orally and intramuscularly, the average daily dose being 4 mg. Atropine locally was the only additional therapy. Clearing progressed gradually from the limbal region centrally, suggesting restoration

of the vitamin factor from the limbal circulation. Of interest is the fact that at no time was there any sign of corneal vascularization.

Owen C. Dickson.

Mata Lopez, Pedro. Chemotherapy with compounds of sulfapyridine in serpiginous ulcer of the cornea. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1942, v. 1, Sept., pp. 286-295.

The author reports his experiences with the use of sulfapyridine by mouth and locally in ointment form in thirty cases of serpiginous ulcer and compares the results with those obtained before the use of the sulfonamides. The percentage of cures was increased from 3 to 5 percent without sulfapyridine to 33 per cent with sulfapyridine.

J. Wesley McKinney.

Nuri Fehmi Ayberk. About trachomatous pannus. *Göz Klinigi*, 1943, v. 1, Aug., p. 13.

The author finds the only efficient local treatment for trachomatous pannus to be 0.5-percent solution of methylene blue combined with atropine. The former drug may have a direct effect upon the trachoma virus and may also help to improve the metabolism of the epithelium of the conjunctiva and cornea. J. Igersheimer.

## 7

### UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Dubourdieu, J., Canabal, E. J., and Gonzalez Vanrell, F. Wallenberg's syndrome. *Arch. Uruguayos de Med., Cir. y Especial.*, 1943, v. 22, June, pp. 544-552.

Most of the patients with this rare syndrome die soon, but the patient whose case is now reported lived for

one year. His bulbar lesion produced a limited left hemiparesis, which was accompanied by difficulty in opening the left eye, enophthalmos, and miosis (Bernard Horner syndrome). There was nystagmus on fixation, and the left corneal reflex was abolished. Each eye had good visual acuity. (References.)

W. H. Crisp.

Fralick, F. B., Cooper, J. H., and Armstrong, R. C. Uveitis with secondary glaucoma. *Trans. Amer. Acad. Ophth. and Otolaryng.*, 1942, 47th mtg., Nov.-Dec., pp. 92-99. (See Section 8, Glaucoma and ocular tension.)

Kravitz, D., and Duest, L. J. Post-operative endogenous infection of the eye with recovery. *Amer. Jour. Ophth.*, 1944, v. 27, Feb., pp. 167-171. (References.)

Rados, Andrew. Fundus lesions in syphilis. *Jour. Med. Soc. New Jersey*, 1943, v. 40, Aug., p. 304.

The pathologic picture of syphilitic lesions of the uveal tract is most commonly found in the choriocapillaris, as against sympathetic ophthalmia in which the deep layers are affected. Pigment epithelium and outer retina are secondarily affected, justifying as more correct the designation of chorioretinitis.

Congenital chorioretinitis, or the typical salt-and-pepper fundus of luetic origin, is about the only characteristic syphilitic lesion. A syphilitic basis for many fundus pictures is assumed from other clinical findings. Vascular pathology due to Buerger's disease, or lesions of Boeck's sarcoid and undulant fever, may require reclassification of signs hitherto described as luetic.

Four types of fundus change in congenital syphilis are described. First,

the bilateral, posterior polar or peripheral, delicate yellowish-red dots mixed with tiny pigment spots of the salt-and-pepper type which are nonprogressive. These may occur independently or in association with the other more frequent forms. Types two and four consist of patches of yellowish red occurring in the extreme periphery and measuring about one-half disc diameter. Pigmentary changes are late, and lesions may be unilateral. The severe form of type two may be hard to differentiate from retinitis pigmentosa. In type three the patches are of lighter color and the pigmentation less marked. This type may occur unilaterally and changes progress from the extreme periphery toward the center. Pigmentation may increase in the late stages, giving a picture similar to that of type two and of which perhaps it is merely one modification.

Acquired syphilitic lesions occurring usually in the second stage are described. Emphasis is placed on vitreous exudation, hazy fundus, frequent bilaterality, and the end picture of small, pigment-ringed central lesions progressing to larger areas at the periphery.

Owen C. Dickson.

Ruby, F. McK. Essential atrophy of the iris. *Amer. Jour. Ophth.*, 1944, v. 27, Feb., pp. 171-175. (4 figures, references.)

Schlaegel, T. F., Jr. A comparison of the ocular reactions of pigmented and albino rabbits to normal horse serum. *Amer. Jour. Ophth.*, 1944, v. 27, Feb., pp. 137-146. (3 tables, 5 figures, references.)

Wienman, G. J. Sympathetic ophthalmitis. *United States Naval Med. Bull.*, 1943, v. 41, Sept., pp. 1392-1396.

The author believes that at least 17.5 percent of all badly injured eyes, if not removed, will lead to sympathetic ophthalmitis. Enucleation should be performed within two weeks of the ocular injury, as the most dangerous period is between the third week and the third month. The prognosis in advanced cases is poor, and the only good treatment is prophylactic enucleation. Sulfanilamide and foreign-protein therapy appear to be of value, but continued cycloplegia is the greatest single factor in the treatment. There is a great tendency for sympathetic ophthalmitis to undergo remissions and exacerbations. No case can be considered quiescent until at least one year has elapsed. The author reviews four cases of sympathetic ophthalmia seen in civilian practice. The first received a knife wound of the uveal tract, and developed sympathetic ophthalmitis in the second eye after approximately six weeks. Notwithstanding enucleation after the second eye became involved, total blindness resulted. In the second case, the condition followed removal of a lens which had been dislocated when the eye was struck by a baseball. Sympathetic ophthalmitis developed after approximately six weeks, the offending eye being removed at that time. Sulfathiazole, foreign protein, and calcium glucinate intravenously, were administered; the corrected vision ultimately being 20/20. On several occasions during one year, the condition recurred following the discontinuance of sulfanilamide. In the third patient, the manifestation of sympathetic ophthalmitis was an optic neuritis, following a subconjunctival scleral rupture, and involving essentially only the posterior segment of the second eye. In the fourth case, total blindness resulted

largely through the patient's lack of cooperation.  
Charles A. Bahn.

Yanamura, H. Y., and Green, R. G. Intraocular virus infections. *Science*, 1943, v. 98, July 9, p. 45.

The authors have succeeded in experimentally transmitting the virus of epizootic fox encephalitis by inoculating the virus into the anterior chambers of eyes of dogs, wolves, and foxes. The application of their technique has aided materially the study of this virus infection, because it results in 100 percent of infections which can be followed by gross observation and can be verified by demonstration of inclusion bodies in stained preparations of the corneal endothelium. The clear-cut results have increased knowledge concerning the spines of animals susceptible to fox-encephalitis virus, and open possible avenues of investigation of other viruses which at present can be demonstrated only with difficulty.

Benjamin Milder.

## 8

### GLAUCOMA AND OCULAR TENSION

Fralick, F. B., Cooper, J. H., and Armstrong, R. C. Uveitis with secondary glaucoma. *Trans. Amer. Acad. Ophth. and Otolaryng.*, 1942, 4th mtg., Nov.-Dec., pp. 92-99.

Secondary glaucoma in cases of iridocyclitis occurred in 22 percent of 1,282 eyes examined. Medical therapy consisting of mydriatics or miotics or their combination in addition to heat, salicylates, foreign protein, and removal of focal or general infection resulted in normalization of the intraocular tension in 30 percent of the eyes. Paracentesis resulted in normal tension in 43 percent of the eyes when

used in active iridocyclitis accompanied by glaucoma. If paracentesis is going to be successful one or two paracenteses at the most are usually sufficient, and after failure of paracentesis on two occasions some other procedure may better be utilized unless the eye shows active inflammatory changes contraindicating other surgery. Of all operative procedures, iridectomy gave the highest percentage (71) of controlled intraocular tension in iritic glaucoma. If the ocular inflammation is first decreased to a minimum, favorable reduction in tension by iridectomy is enhanced. Corneoscleral trephining was successful in reducing elevated intraocular tension in 60 percent after the iridocyclitis became quiescent. This operation is not indicated in eyes showing active uveitis. Cyclodialysis, iridencleisis, transfixation of the iris, and combined extraction of complicated cataract in quiescent iridocyclitis with secondary glaucoma, resulted collectively in reducing the tension to normal in 62 percent of the eyes operated upon. Sixty-seven (25 percent) of the eyes showing glaucoma after development of primary iridocyclitis were primarily or finally enucleated. (9 tables.)

Gertrude S. Hausmann.

Gradle, H. S., and McGarry, H. I. Why a glaucoma clinic? *Trans. Amer. Acad. Ophth. and Otolaryng.*, 1942, 47th mtg., Nov.-Dec., pp. 100-105.

The value of the glaucoma clinic is mainly that 95 percent of the people afflicted with glaucoma are kept under observation for two years or more, whereas previously 96 percent of them disappeared within two years. Analysis of the first 283 eyes with primary glaucoma observed over a period of two years shows that the better the visual

acuity and the visual fields are at the time of the discovery of the disease the better is the chance of preservation of useful vision by continued observation and treatment. Of all the eyes with useful vision, only 14 percent became practically blind within two years. Loss of vision in the peripheral field usually precedes loss of central visual acuity. (4 tables, discussion.)

Gertrude S. Hausmann.

La Motte, W. O. Primary glaucoma, its etiology, symptoms, and diagnosis. *Delaware State Med. Jour.*, 1943, v. 15, June, p. 101.

This paper presents a brief survey of glaucoma, intended for a nonophthalmologic medical group. Various reports of the incidence of blindness due to glaucoma range up to 20 percent. A classification of glaucoma is presented, primary glaucoma being divided into acute inflammatory, chronic inflammatory, and chronic simple types.

The early signs and symptoms of each of the three types are described, emphasizing differentiation from conjunctivitis and acute iritis. The early transient symptoms are described, along with cautious provocative tests for early cases. The importance of visual-field studies is brought out, and an illustrative case is cited.

Benjamin Milder.

Lloyd, R. I. Glaucoma and the general practitioner. *New Orleans Med. and Surg. Jour.*, 1943, v. 96, Aug., p. 67.

The author summarizes the mechanism by which increased intraocular pressure impairs visual acuity and the field of vision. Briefly, in nontechnical language, the author outlines the signs and symptoms of glaucoma, the methods of diagnosis, and the responsibility

of the general practitioner in education of the public and control of glaucoma.  
Benjamin Milder.

McLean, J. M. What everyone should know about glaucoma. *Sight-Saving Review*, 1943, v. 13, no. 2, p. 83.

In simple readable style the article tells the public of the importance of glaucoma, its symptoms, and its control. The author advises all who are middle-aged or older to find out if they have the condition.

Robert N. Shaffer.

Moreu, Angel. The vascular factor in the treatment of glaucoma. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1942, v. 1, Sept., pp. 272-281.

This report is based on gonioscopic observation of one hundred cases of various types of primary glaucoma. In all hypertensive eyes an edema of the ciliary body and of the root of the iris was observed, manifested by a dark-bluish coloration and fine spots of exudation. This was interpreted to be an edema due to venous congestion rather than inflammatory edema. Successful operation or medical treatment caused disappearance of the edema but, if the tension was not completely normalized or if loss of vision and field continued despite normalization of tension, the edema persisted. All of the patients were stated to have either hypertension, arteriosclerosis, circulatory disturbance, or disequilibrium of the sympathetic-parasympathetic nervous system. Glaucoma was found to be in large part caused by a circulatory disturbance which was both local and general.

The classical medical and surgical treatment of glaucoma was employed with the addition of a vasodilator drug

"Lacranol." This is a sodium nucleotide extracted from the muscles and blood of warm-blooded animals. Taken by mouth it produces capillary dilatation without affecting appreciably the arterial pressure or intestinal musculature.  
J. Wesley McKinney.

Torres, Estrada A. Modifications of Heine's cyclodialysis. *Jour. Internat. College of Surg.*, 1943, v. 6, July-Aug., p. 378.

The modification consists in making the scleral opening only 4 to 5 mm. wide and placed at the 8 o'clock position in the right eye and at 4 o'clock in the left. A special spatula, set at an angle of  $145^\circ$  with the shaft, is introduced and the ciliary body is separated from the sclera for  $180^\circ$ . Both eyes are operated upon at a single session. The procedure is simple, involves no danger to sight, and is especially recommended in advanced glaucoma. The authors consider that cyclodialysis with ample separation is the only operation indicated for glaucoma. (2 figures.)

Eugene M. Blake.

## 9

### CRYSTALLINE LENS

Bellows, J. G., and Nelson, D. Anoxia cataract. *Proc. Soc. Exper. Biol. and Med.*, 1943, v. 54, Oct., p. 126.

Rats were placed in a steel chamber in which the pressure was gradually reduced to an equivalent of 30,000 feet or more altitude. Fifty percent of the rats died. Seventy-five percent of the dead animals and 10 percent of the survivors showed lens opacities. To prove that anoxia alone is the important factor in producing cataract and that pressure and asphyxia are unimportant, rats were placed in a glass



chamber through which a mixture of 5 percent oxygen and 95 percent nitrogen was constantly flowing, the rats developing cataract under these conditions.

Since lactic acid plays a great role in the oxidation process of the lens, the lactic-acid content of the aqueous at high altitudes was determined. The aqueous humor of one eye in each animal was removed. After two hours for recovery the animals were placed in a decompression chamber, some being kept for control. The lactic-acid content of the aqueous of the second eye was three to four times as high as that of the first eye or of the controls. The pH of the aqueous was found unaltered in high altitude.

After decompression the iris is hyperemic. In the superficial cortex diffuse gray opacities are visible. The anterior superficial suture becomes more readily visible. Similar although less marked changes are found in the posterior cortex. In severe cases the fiber structure is lost and a glistening white total cataract is formed. After an hour the cataract gradually regresses.

The authors examined the lenses of human volunteers subjected to decompression equivalent to 18,000 feet altitude, but no lens opacities were noted.

R. Grunfeld.

Berkove, A. B. Asthenopia and amblyopia caused by congenital lens-vitreous changes. *The Military Surgeon*, 1943, v. 93, Nov., p. 415.

The author describes a symptom complex characterized by defective vision and painful, light-sensitive eyes. Slitlamp studies reveal mutton-fat opacities scattered throughout the lens, sclerotic posterior Y, and coarse lamellar structure in the vitreous. The writer

reports five cases as examples of 25 cases studied. It is suggested that the condition is frequent in cases of unexplained amblyopia.

Robert N. Shaffer.

Buschke, Wilhelm. Classification of experimental cataracts in the rat. *Arch. of Ophth.*, 1943, v. 30, Dec., pp. 735-750.

Cataract formation has been observed in the rat under a number of different conditions. It has been found that feeding the rat a diet deficient in tryptophane produces either an acute or chronic form of cataract, whereas addition of tryptophane to the diet causes arrest in cataract formation. Microchemical studies show that there is never a complete loss of bound indole from the lens even in the advanced stages of tryptophane-deficiency cataract. Such cataracts are associated with inhibition of body growth and alterations in other epithelial structures, namely cornea, hair, and testicular epithelium. Attention is called to the fact that lens, hair, and testicle are all epithelial tissues that continue to grow throughout life. Cataracts resulting in rats from thallium poisoning and from riboflavine deficiency are also associated with similar changes in cornea, hair and testicular epithelium.

On the basis of morphology, development, and allied symptoms, a classification of experimental cataracts in rats includes three principal groups, the diabetic, the tetanic, and the dystrophic. The diabetic group includes cataract associated with experimental diabetes as well as galactose and xylose cataracts; the tetanic group includes cataracts occurring in the course of dietary and postoperative tetany; and the dystrophic group, the cataracts ac-

companying riboflavine deficiency, chronic thallium poisoning, and tryptophane deficiency. The article is illustrated by slitlamp drawings of the various types of lens changes. (11 figures, references.) John C. Long.

Buschke, Wilhelm. Dystrophic cataracts and their relation to other "metabolic" cataracts. *Arch. of Ophth.*, 1943, v. 30, Dec., pp. 751-762.

The author divides both experimental and clinical "metabolic" cataracts into hyperglycemic, tetanic and dystrophic groups. The dystrophic group is discussed in some detail and is subdivided in the following classification: (A) Experimental conditions: 1, riboflavine deficiency; 2, experimental chronic thallium poisoning; 3, experimental tryptophane deficiency. (B) Clinical cataract syndromes with predominantly atrophic dermatoses: 1, Rothmund syndrome; 2, Werner syndrome. (C) Cataract syndrome, with dermatoses of the atopic dermatitis type: Andogsky syndrome. (D) Clinical cataract syndromes associated with other cutaneous conditions, including those associated with follicular keratosis, telangiectasis, or myxedema, or with anomalies of the hair. (E) Cataract associated with mongolism and with myotonic dystrophy.

Typically the dystrophic cataracts are associated with alterations in other structures of the body. Primary endocrine dysfunction does not effectively explain the occurrence of these cataracts. The author concludes that the lesions are probably due to primary metabolic disturbances in the affected tissues on a hereditary basis. (Bibliography.) John C. Long.

Butler, T. H. Cataract extraction. *Brit. Jour. Ophth.*, 1943, v. 27, Nov., pp. 495-509.

The advantages of drawing as a means of training the fingers for cataract surgery are emphasized. Medical students should have to pass an examination in drawing.

The most important preparation of the patient is psychologic. He should come to operation free from fear and confident of a successful outcome of his operation. The simpler the physical preparation is, the better. The patient must be examined for foci of infection, especially the teeth. The lacrimal sacs should be irrigated a few days before the operation, not on the day before. A culture should be taken 48 hours prior to operation, for medico-legal reasons if for no other. The tears contain their own antiseptic, and washing with normal saline just before operation is the author's only local treatment.

The only general treatment is to have the bowels properly emptied. If a preliminary iridectomy is to be done, eserine must be used with the cocaine because it is difficult to perform a neat iridectomy on a dilated pupil. No preliminary narcotics are used.

The advantages of a preliminary iridectomy are these: It gives the surgeon an indication of how the patient will behave at extraction and the size of the lens can be estimated in the coloboma. The cataract section is much easier to make when there is no danger of wounding the iris. For the preliminary iridectomy, a keratome incision is used and an iris hook is substituted for forceps. The patient goes home on the fourth day if there is no infection.

Extraction is done a month after the preliminary iridectomy. The author uses a projection lamp to avoid reflections. A nurse holds one of the patient's hands centrally over the chest. Then the patient is not asked to look down, but to look at his hand.

For akinesia an injection of novocaine and adrenalin into both lids and into the temple is used half an hour before operation. No retrobulbar injection is used.

The section is made with a speculum in place. The speculum is removed after the section. Visible cortex is expressed with a lens spoon. No attempt is made to wash out cortex. If vitreous is lost, the eye is closed at once and is not opened for four days. If the iris is then impacted, it can be dealt with under a general anesthetic.

If capsulotomy of aftercataract is necessary it should be done within a month after operation if the eye is free from inflammation. At this time, the zonule is still maintaining some tension upon the capsule, and if a vertical incision is made the slit gapes and gives an oval aperture. The Ziegler knife should not be introduced through the clear cornea but through the limbus.

Alternative types of extraction are considered. Simple extraction with a round pupil is objectionable because of the amount of pressure on the globe which is necessary and the trauma to the iris. Extraction under a conjunctival bridge makes it difficult to deliver the lens and there is often an extreme degree of astigmatism. The author considers the intracapsular operation far more dangerous than any other type because of the heavy pressure he has found necessary to deliver the lens. He has performed very few such operations and will never do any more!

Edna M. Reynolds.

Gemeroy, J. C. Intracapsular cataract extraction. *Michigan State Med. Soc. Jour.*, 1943, v. 42, Oct., p. 812.

The author describes a modification of Dimitry's suction syringe wherein it is possible to release the plunger—

to create the vacuum at the instrument tip—while still holding the syringe near its base with thumb and fingers. Its application in 56 cases is reported. In six of these there had been failure to remove the lens by other intracapsular methods. Suction was applied at the upper anterior portion of the capsule and the lens slid out rather than tumbled. Thirty-five of fifty cases required iridectomy, while in 15 dilatation of the pupil was sufficient to allow retention of a round pupil.

The difficulties encountered with this method are illustrated by a case in which the zonule failed to rupture in a 17-year-old diabetic, rupture of the lens capsule after applying suction, in four cases of hypermature cataract, and one case of rupture of the capsule on introducing the tip. Prolapse of the iris occurred in two cases and retinal detachment in three of the 56 cases. Vitreous was lost in seven cases but not as a result of its being sucked into the syringe. This method does not supplant others but affords a help which may be valuable, as demonstrated in six of the author's complicated cases.

Owen C. Dickson.

Goldsmith, Jacob. Original studies on the internal dynamics of the intracapsular cataract extraction. *New York State Jour. Med.*, 1943, v. 43, Sept. 15, pp. 1739-1750. (See *Amer. Jour. Ophth.*, 1943, v. 26, June, p. 640.)

Howell, T. J. A plea for the intracapsular extraction of cataract. *South African Med. Jour.*, 1943, v. 17, Sept. 11, p. 275.

Essential requisites for a successful intracapsular extraction in the hands of the author are briefly described. These include lid akinesia, a slowly administered retrobulbar injection, and

superior rectus and corneal sutures. A fairly large limbal section made the best start. Next came a small peripheral iridectomy or iridotomy in a pupil moderately dilated (not by atropine). After breaking the zonule and rotating the lens, with the latter fixed in the wound, the capsule forceps were released and reapplied, and the lens was delivered by lateral rotatory pulling movements. Eserine 0.5 percent and cocaine 2 percent in oil were instilled into the conjunctival sac.

Elimination of the possibility of glaucoma or delayed union from incarcerated capsule, avoidance of capsulotomy after the extraction, and the perfect cosmetic result obtained from a successful intracapsular extraction far outweigh the very limited disadvantages of the operation.

Francis M. Crage.

Kirby, D. B. The development of a system of intracapsular cataract extraction. *Amer. Jour. Ophth.*, 1944, v. 27, Feb., pp. 124-136. (References.)

Knapp, Arnold. Retinal detachment and trauma. *Arch. of Ophth.*, 1943, v. 30, Dec., pp. 770-774; also *Trans. Amer. Ophth. Soc.*, 1943, v. 41. (See Section 10, Retina and vitreous.)

McDannald, C. E. Neurodermatitis with cataract. *Arch. of Ophth.*, 1943, v. 30, Dec., pp. 767-769.

Two cases of neurodermatitis with cataract were observed in white patients, one a man of 18 and the other a woman of 23 years. Both patients were emotionally unstable and reacted positively to many different tests for allergy. The skin of the eyelids was brawny, red, and itchy in each case. In each patient, cataract appeared and matured rapidly during the active stage

of eczema and neurodermatitis. Linear cataract-extractions were performed with good results on all four eyes involved. The woman failed to get normal vision because of a coexisting bilateral keratoconus. Apparently cataracts associated with neurodermatitis lend themselves well to surgical intervention. (References.) John C. Long.

Marback, H. Sign of oil drop in pupil; microphakia; anterior lenticonus. *Arquivos Brasileiros de Oft.*, 1943, v. 6, Aug., pp. 119-124.

A man aged 23 years came to the clinic on account of poor vision which had existed since infancy. The pupils reacted well to light, and had an average diameter of 2 mm. The skiascopic examination indicated myopia of 30 diopters. Under atropine each eye showed a brilliant circle coinciding exactly with the equator of an abnormally small lens, the lens diameter appearing to be approximately 4 to 5 mm. There were two distinct pupillary zones, one inner, central, opalescent, the other peripheral but clear, the whole picture giving the appearance classically described as "oil drop in the pupil." Ophthalmoscopy showed in each eye two images of the ocular background, one central and direct, the other peripheral and inverse. The sudden interruption at the boundary between the two images made it impossible to follow the course of the retinal vessels.

Biomicroscopy indicated a spherical deformity of the anterior face of the lens, with anterior chamber very shallow, the anterior pole of the lens being hardly 2 mm. behind the cornea. The deformity appeared to exist at the expense of the anterior capsule and the anterior half of the senile nucleus, the fetal nucleus having a normal aspect. The zonula was visible in the whole

circumference, but there was a reduced number of suspensory fibers. The lens was not dislocated. (Illustrations, references.)  
W. H. Crisp.

Neblett, H. C. Ulcer of the cornea at the site of the corneal-suture wound. *Southern Med. and Surg.*, 1943, v. 105, Oct., p. 452.

Cataract extraction was performed on two negro women, one aged 67 and the other 70 years. Each gave the history of having had multiple chalazion of the lids of each eye over a period of years. On the fifth and seventh day respectively after the operation the eyelids became indurated and an ulcer developed at the site of the suture wound. The ulcer was round and had no tendency to undermine. In one case recovery was had with fair vision; in the other, which was complicated by severe and protracted uveitis, light perception only was secured. The author concludes that corneoscleral sutures are contraindicated in any case presenting a history of a chronic inflammation of the lids, of the lacrimal apparatus, or of the globe.

R. Grunfeld.

Stone, L. S. Factors controlling lens regeneration from the dorsal iris in the adult *Triturus viridescens* eye. *Proc. Soc. Exper. Biol. and Med.*, 1943, v. 54, Oct., p. 102.

Slight injuries to the fully developed lens in the adult salamander eye cause the lens to degenerate, and in such cases a new lens develops from the dorsal pupillary margin of the iris. If a piece of a dorsal iris from a normal eye is transplanted to a lenssectomized host eye a new lens will develop from the graft. If, however, the host eye possesses a normal lens the latter strongly inhibits lens regeneration. Ex-

periments proved, moreover, that the presence of a regenerating lens from an iris not older than 25 days in a lenssectomized eye does not inhibit nor prevent the regeneration of a lens from other dorsal iris-tissue in its environment, and under some circumstances even three lenses may grow in the same eye. If the regenerating-lens is older than 25 days it inhibits lens regeneration from another iris tissue.

R. Grunfeld.

Torres Estrada, A. Surgical procedure in the operation of cataract. *Jour. Internat. College of Surg.*, 1943, v. 6, July-Aug., p. 301.

Torres Estrada considers akinesia of the lids and wound sutures the most important details of technique. He employs two corneoscleral sutures, one at the ten o'clock and one at the two o'clock position, leaving a conjunctival bridge above. A small inverted-V-shaped cut in the conjunctiva at the 12 o'clock position permits performance of a peripheral iridectomy, the cut being afterward sutured. The lens is extracted with an erisiphake or with capsule forceps. (8 figures.)

Eugene M. Blake.

Wolfe, O. I., and Wolfe, R. M. The Barraquer technique in incipient cataract and glaucoma. *Jour. Internat. Col. Surg.*, 1943, v. 6, July-Aug., p. 354.

The authors feel that intracapsular extraction is the procedure of choice in cataract occurring in or with incipient glaucoma. They prefer a modification of the Barraquer erisiphake technique with the addition of a punch sclerectomy. The incision is made with a keratome 1.5 mm. above the limbus, and is enlarged with scissors. Two corneoscleral sutures are placed before the section is made, and several con-

junctival sutures at the end of the operation. Details as to the amount of suction vacuum employed are given and stress is laid upon a careful general preoperative study of the patient. (6 figures.)

Eugene M. Blake.

Owen C. Dickson.

## 10

### RETINA AND VITREOUS

Arruga, H. Search for and localization of retinal tears. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1942, v. 1, Aug., pp. 173-180.

The importance of exact localization of tears before and during the operation for retinal detachment is emphasized. Not only must the tear be sealed but the less the amount of diathermy used the less will be the postoperative reaction and the greater will be the probability of success. With the modern technique, reattachment should be obtained in 70 to 80 percent of the cases operated upon. The various methods of localizing tears are reviewed.

J. Wesley McKinney.

Ballantyne, A. J. **Retinal hemorrhage.** *Irish Jour. Med. Science*, 1943, sixth series, Oct., p. 551.

A sudden rise of pressure in the venous circulation as it occurs in thrombosis, choked disc, or subarachnoidal hemorrhage will result in venous stasis with consequent hemorrhage in the retina. But the distribution of the hemorrhage will differ in the three conditions mentioned.

Although in thrombosis of the central retinal vein the hemorrhage may be sudden, it is nevertheless only the final phase of a progressive, gradually developing obstruction of the venous circulation. The walls of the veins covering a wide area have suffered for a long time from the consequent anox-

emia, and the hemorrhage, therefore, will be widespread. In papilledema and subarachnoid hemorrhage, however, the retinal hemorrhage takes place near the disc, where the surrounding tissues give diminished support to the venous wall. Furthermore, the hemorrhages often form a sleeve or cuff on the veins as they leave the disc.

Capillary hemorrhage predominates when the hemorrhage is seen between the visible retinal vessels. If a blood vessel passes through such a hemorrhage it is accompanied by a blood-free zone, a pale band on either side of the blood column, corresponding to the capillary-free zone which lies on either side of the retinal arteries.

Of arterial origin are the striate and fan-shaped hemorrhages lying in the nerve-fiber layer where the first capillary plexus is situated. Of venous origin are the punctate or petechial hemorrhages which take their origin from the efferent venules forming the deepest capillary plexus in the outer molecular layer. From these the arterial aneurysms have to be differentiated. The latter are round, blood-red masses whose diameter is about that of a secondary retinal vein, and which have a glistening reflex at their center giving the impression that they are encapsulated.

Punctate hemorrhages do not show a surface reflex, and when they occur in the perimacular region they are pathognomonic of diabetes mellitus. In retinitis circinata the hemorrhage has a petechial character, while in disciform degeneration the preceding hemorrhage consists of an ill-defined splotch.

R. Grunfeld.

Berkove, A. B. **Asthenopia and amblyopia caused by congenital lens-vitreous changes.** *The Military Sur-*

geon, 1943, v. 93, Nov., p. 415. (See Section 9, Crystalline lens.)

Cordes, F. C. The use of vasodilators in acute fundus diseases. *Ophth. Ibero Amer.*, 1943, v. 4, no. 4, pp. 435-558 (in Portuguese); pp. 449-461 (in English). (See *Amer. Jour. Ophth.*, 1943, v. 26, Sept., p. 916.)

Esteban, Mario. So-called "black vision" and "red vision" of aviators. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1942, v. 1, Sept., pp. 251-268.

Studies of the effects of centrifugal force on the human body have been stimulated by the importance of aviation in modern warfare. In dive-bombing and the normal "loop" the head remains inside and the feet outside in relation to the curvilinear movement of the airplane. The displacement of the blood is directed away from the head to the abdomen and lower extremities, causing ischemia of the head. The retinal circulation is particularly susceptible to the exsanguinating effect of centrifugal force acting in the above manner, and gives the first danger signal before other symptoms develop. Forms and colors disappear. A black veil falls before the eyes, giving rise to the phenomenon of "black vision." Then, if the action of centrifugal force is more marked, total loss of consciousness occurs. The effect last only momentarily, as the pilot comes out of the turn with consequent lessening of the centrifugal force.

More dangerous than the above are the outside loops in which the feet and abdomen occupy the inside position and the head the outside. The blood and cerebrospinal fluid are displaced toward the head, with consequent increase in intracranial and intraocular pressure. The pilot experiences a fullness of the

head which may suddenly become a headache, followed by a blackout. The loss of consciousness lasts only momentarily, but the headache often persists several hours. Often ecchymoses of the conjunctiva, eyelids, and cheeks are produced, and there is a real danger of cerebral hemorrhage. In the case of outside loops retinal circulation is protected by the increased intraocular pressure, and retinal hemorrhages are rare. J. Wesley McKinney.

Knapp, Arnold. Retinal detachment and trauma. *Arch. of Ophth.*, 1943, v. 30, Dec., pp. 770-774; also *Trans. Amer. Ophth. Soc.*, 1943, v. 41.

As it is not yet exactly known how a detachment of the retina is produced, the relation to trauma must remain vague. The author studied four hundred cases of detachment, obtaining in 52 a definite history of trauma. Traumatic origin of detachment is obvious in cases in which there has been a puncture wound or direct trauma to the eye. The cause of detachment where there has been indirect trauma is much more obscure. Detachment is often associated with injuries involving generalized jarring or lifting, or with coughing or sneezing. It is assumed that many detachments follow indirect injuries in eyes already predisposed to detachment. Among predisposing factors may be considered myopia, cystoid degeneration of the retina, degeneration due to local circulatory disturbances, and changes in the vitreous. Predisposition to detachment is evidenced by the fact that of the cases here reviewed, 14 percent showed bilateral involvement.

Detachment of the retina was observed in 37 cases of aphakia. Predisposition and loss of vitreous are thought to be factors in this complica-



tion. Detachment has been frequently observed after needling and either extracapsular or intracapsular extraction. Operation for congenital cataract seems to have an especially bad prognosis. This may be because of the greater length of life after the operation. In a series reported by Shapland, the detachment occurred at an average interval of 24.6 years after removal of congenital cataract. (References.)

John C. Long

Laval, Joseph. Coats's disease. *Amer. Jour. Ophth.*, 1944, v. 27, Feb., pp. 163-167. (3 figures, references.)

Lijo Pavia, J. The central artery of the retina. Provocative pulsation. Its analysis by photography. (Part 1.) *Rev. Oto-Neuro-Oft.*, 1942, v. 17, May-June, pp. 79-85. (See also paper by Lijo Pavia and Cerboni.)

The author uses an ophthalmodynamometer for making pressure on the eyeball to produce the arterial pulse, photographs of the fundus then being made for corroboration and study. As in a previous paper, he finds that the appearance, under pressure, of the arterial pulse represents the minimal arterial pressure. He gives due credit to Bailliart's observations.

In his own observations of three cases (his fundus photographs are well done in progressive frames), the dynamometer is used to gradually increase the pressure made upon the eyeball to the point of arterial collapse or contraction during diastole (known as the median pressure). He discovered that in hypertensive patients this phase of arterial contraction was more prolonged than in normal individuals, and he interpreted this as a latent state of

angiospasm. Further reports on this subject are to follow.

Edward Saskin.

Lijo Pavia, J., and Cerboni, F. C. The central vessels. Double retinal pulse. Photograph evidence. (Part 1.) *Rev. Oto-Neuro-Oft.*, 1942, v. 17, March-April, pp. 47-51.

The authors state that the spontaneous and evident retinal venous pulsation depends on the equilibrium established between the pressure of the retinal veins and the intraocular pressure, the former being dependent upon the power of the cardiac contractions. Evidence is offered to the effect that the venous pulse is present in only 37 percent of all individuals.

Applying an ophthalmodynamometer to the eye it is found that the venous pulse is a manifestation of the ventricular systole. Continued pressure on the eyeball causes disappearance of the venous pulse at the time of auricular systole, by reason of neutralization of the maximum intravenous pressure. Further compression of the eyeball now causes appearance of an arterial pulsation, indicating the minimal arterial pressure, and normally no visible venous pulse. However, in certain cases, the venous pulsation persists in spite of pressure on the eye with the dynamometer, the phenomenon known as a "double retinal pulse." The authors feel that persistence of the venous pulse under pressure on the eye is due to poor return circulation which causes a rise in the venous pressure almost to the level of the arterial pressure. In a case of central retinal-vein closure here reported, the dynamometer revealed a double retinal pulse. The authors' findings are substantiated with a fundus photograph.

Edward Saskin.

Lister, A., and Bishop, J. W. Night vision in the Army. *Brit. Med. Jour.*, 1943, Sept. 11, p. 325. (See Section 3, Physiologic optics, refraction, and ocular vision.)

Loewenstein, A., and McGregor, I. S. Senile and other pigmentary changes in the retinal ganglion cells. *Brit. Jour. Ophth.*, 1943, v. 27, Nov., pp. 486-495.

To determine whether the basis for staining of ganglion cells with scarlet red in hypertensive and diabetic retinopathy was just a senile change or was really pathologic, an investigation of fatty changes in the ganglion cells in normal eyes of different age-groups and in various diseased conditions was undertaken.

The ganglion cells of the middle-aged and aged show fatty droplets of lipid staining in the plasma. In children, these changes are absent for the most part, but they do occur. The droplets may be so small as to be scarcely discernible, or so gross that the whole plasma may be full of them. The large ganglion cells of the periphery suffer predominantly. The smaller central ganglion cells are much less affected or not at all.

Apart from the brilliant droplet staining of the ganglion cells with scarlet red, the plasma of the ganglion cells of the periphery in senile retinas stained with scarlet red had frequently a brownish appearance, due to the presence of diffuse brown pigment, which may be a precursor of lipid. Diseases such as hypertension, diabetes, and glaucoma cause pigmentary changes in the retinas of younger people similar to the changes seen in senile retinas. (11 illustrations, references.)

Edna M. Reynolds.

Rados, Andrew. Fundus lesions in syphilis. *Jour. Med. Soc. New Jersey*, 1943, v. 40, Aug., p. 304. (See Section 7, Uveal tract, sympathetic disease, and aqueous humor.)

## 12

### VISUAL TRACTS AND CENTERS

Esteban, Mario. So-called "black vision" and "red vision" of aviators. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1942, v. 1, Sept., pp. 251-268. (See Section 10, Retina and vitreous.)

Lyle, D. J. Eye manifestations of head injuries. *Jour. Amer. Med. Assoc.*, 1943, v. 123, Dec. 4, p. 873. (See Section 16, Injuries.)

Moreu, Angel. Considerations on the ophthalmologic diagnosis of hypophyseal tumors. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1942, v. 1, Aug., pp. 181-211.

An exhaustive article on the anatomic and clinical aspects of this subject. Six illustrative cases are reported briefly, with field charts.

Nuri Fehmi Ayberk. About the importance of ocular symptoms in cerebral tumors. *Göz Klinigi*, 1943, v. 1, Aug., p. 1.

The author underlines the great importance of the ophthalmologist in all questions concerning diagnosis and treatment of brain affections, especially brain tumors. The article is based mainly upon statements in the literature, not upon personal experience.

J. Igersheimer.

## 13

### EYEBALL AND ORBIT

Dubourdieu, J., Canabal, E. J., and Gonzalez Vanrell, F. Wallenberg's

syndrome. Arch. Uruguayos de Med., Cir. y Especial., 1943, v. 22, June, pp. 544-552. (See Section 7, Uveal tract, sympathetic disease, and aqueous humor.)

Gifford, S. R. Plastic shell for use in the simple evisceration of the globe. Arch. of Ophth., 1943, v. 30, Dec., pp. 775-776.

The only disadvantage noted in simple evisceration of the globe by the method of Harold Gifford has been the occurrence of conjunctival chemosis. As the conjunctiva is not cut during this operation, a very considerable amount of fluid may accumulate under it. The author has devised a plastic shell which can be fitted over the evisceration stump so that constant and uniform pressure is applied. This not only prevents chemosis but by holding the cornea and sclera in correct position produces a better stump. Employment of the shell is also of advantage after enucleation with implant in Tenon's capsule. (One illustration.)

John C. Long.

Lloyd, R. I. Embryological basis of extrapapillary coloboma and conus. Trans., Amer. Acad. Ophth. and Otolaryng., 1942, 47th mtg., Sept.-Oct., pp. 7-16.

There are two types of developmental error of the human eye connected with the pigment layer, the lamina vitrea, and the choriocapillaris. These are extrapapillary coloboma, and the defects located in and about the optic nerve and known as conus, coloboma, or ectasia. Extrapapillary coloboma is named to distinguish it from defects due to defective closure of the optic fissure. These characteristic lesions are located in and about the posterior pole, are multiple or single, of

variable size and unilateral or bilateral. Histologic examination of the affected area shows only the inner retinal layer in the affected areas. The pigment layer is missing and the choroid consists only of a few shreds of pigmented tissue. The sclera may be reduced to a thin layer which may bulge, producing the change in level seen in the more serious defects. Important is the differential diagnosis of these lesions from chorioretinal tuberculosis, hereditary macular degeneration, and the results of trauma with hemorrhage. (14 illustrations.)

Gertrude S. Hausmann.

Pérez Llorca, J. A case of cryptophthalmia. Arch. de la Soc. Oft. Hisp.-Amer., 1942, v. 1, Sept., pp. 269-271.

The condition is defined as a neof ormation wherein the skin passes in front of the eye to the face without solution of continuity, that is, without a trace of palpebral fissure. A case is reported with the pathologic findings.

J. Wesley McKinney.

Smelser, G. K. Water and fat content of orbital tissues of guinea pigs with experimental exophthalmos produced by extracts of the anterior pituitary gland. Amer. Jour. of Physiology, 1943, v. 140, Dec., pp. 308-315.

The author's experiments on animals show that when an extract of anterior pituitary gland is injected into thyrectomized guinea pigs these become affected by exophthalmos with hypertrophy of the retrobulbar fat and extraocular muscles. This effect is due mostly to increase in the amount of interstitial water in these tissues but in part to increase of connective tissue in the orbital fat. The extract used was prepared from the anterior lobe of beef pituitary gland, and 15 to 20 mg. was

injected subcutaneously daily for 60 to 70 days. The animals had been thyrectomized 10 to 20 days prior to the first injection. The methods of the experiments are given in detail and the results on orbital and nonorbital tissues are shown in tabulation form. Table 1 shows a comparison of water and lipid content of the orbital tissues of control and exophthalmic guinea-pigs, and table 2 a comparison of water content of non-orbital tissues of control and exophthalmic guinea-pigs. A discussion on the result closes the article, with the statement that the cause of the increase in water content is the same in both fat and muscle and that an increased vascular permeability may possibly be the factor immediately responsible for this change. The finding that the water content of nonorbital tissues is also increased may be correlated with clinical observations of localized edema in non-orbital tissues of persons with exophthalmos.

Melchior Lombardo.

Stone, L. S. Return of vision in transplanted adult salamander eyes after several days of refrigeration. *Proc. Soc. Exper. Biol. and Med.*, 1943, v. 54, Oct., p. 44.

Fifty-nine adult *triturus viridescens* eyes were refrigerated in sterile Ringer's solution at temperatures varying from 0 to 8 degrees centigrade, and for periods varying from 2 to 14 days and were then transplanted into freshly denuded orbits of new hosts. The best results were achieved when the eyes were preserved at between 4 and 6 degrees centigrade and for not longer than three days, the eyes in some cases recovering vision at the end of three months. If the eyes were kept on refrigeration for a longer period than three days or the temperature was

higher or lower than the optimum given above, the results were correspondingly poorer.

R. Grunfeld.

## 14

### EYELIDS AND LACRIMAL APPARATUS

Belmonte Gonzáles, Nicolas. Totipotential operation without sectioning the internal palpebral ligament. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1942, v. 1, Aug., pp. 167-172.

The operation differs from the original in that the incision begins at the level of the internal palpebral ligament and extends rather farther downward, and the ligament is not cut. Although this modification makes the operation somewhat more difficult, the canaliculi are more surely left intact and the muscular action of the orbicularis, which propels the tears into the sac, is preserved. J. Wesley McKinney.

Sugar, H. S. Tarsconjunctival sliding-graft techniques for eyelid reconstruction. *Amer. Jour. Ophth.*, 1944, v. 27, Feb., pp. 109-123. (13 figures, references.)

Thygeson, Phillips. Staphylococcal blepharitis. *Trans. Amer. Acad. Ophth. and Otolaryng.*, 1942, 46th mtg., July-Aug., pp. 265-272.

In a series of 249 cases, pathogenic staphylococci were found to be an important primary cause of marginal blepharitis. Increased activity of the sebaceous glands of the lids or the meibomian glands seemed also to be a very important causative agent. Staphylococcal blepharoconjunctivitis is characterized by extreme chronicity and by resistance to treatment of corneal complications and internal and external hordeola. Specific antistaphylococcal therapy consisting of staphylococcus toxoid, and local application

of sulfathiazole in ointment form, proved more effective than other methods in producing permanent healing. In only a small percentage of cases was rapid healing obtained, most cases requiring prolonged treatment. Important supplemental treatment included expression of secretion from meibomian glands and epilation of infected cilia. Gertrude S. Hausmann.

## 15

## TUMORS

McBean, G. M. Bilateral metastatic carcinoma of choroid. *Arch. of Ophth.*, 1943, v. 30, Dec., p. 776.

A woman aged 52 years had had both breasts amputated for carcinoma. There was recurrence about the right clavicle. The right eye developed an area of episcleritis temporally and a pale gray zone was observed in the fundus under the insertion of the lateral rectus muscle. Glaucoma appeared and failed to respond to an iridectomy. The eye was removed and on microscopic examination was found to have a metastatic carcinoma under the insertion of the external rectus muscle. Numerous other metastases developed, and the left eye became blind from a wide retinal detachment which covered a solid growth. Although post-mortem examination of the eye was not permitted, it was assumed that the left eye was also the site of a metastatic growth.

John C. Long.

## 16

## INJURIES

Arruga, H. Radiographic localization of ocular foreign bodies. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1942, v. 1, Sept., pp. 282-285.

The author reviews the known methods of localization of intraocular foreign bodies and proposes a simple and

effective method of his own. The procedure consists in inserting small suture needles with attached threads into the episcleral tissue in the approximate region of the foreign body as indicated by the wound of entrance and by posterior-anterior and lateral X rays. When the needles have been inserted the X rays are repeated, giving an exact localization in relation to the needles.

J. Wesley McKinney.

Carlisle, J. M. Medical first aid in eye accidents and injuries. *Sight-Saving Review*, 1943, v. 13, no. 2, p. 75.

The author summarizes methods of first-aid treatment. He points out that usually only a physician should do more than the most superficial of treating. Various neutralizers for chemical burns are listed, together with suggestions as to follow-up care, stressing the late dangers from alkali burns, and care needed to avoid symblepharon in any of them.

Methods of handling superficial foreign bodies are given. It is suggested that all cases of penetrating foreign body and all but the most superficial corneal abrasions be sent immediately to an eye specialist. Proper early treatment can minimize or prevent permanent disabilities. All but the most trivial cases should be promptly referred to an ophthalmologist.

Robert N. Shaffer.

Cogan, D. G., Kinsey, V. E., and Drinker, P. Infrared therapy of flash keratoconjunctivitis. *Jour. Amer. Med. Assoc.*, 1943, v. 123, Dec. 4, p. 883.

Infrared therapy was of no benefit in keratoconjunctivitis produced in rabbits by exposure to a mercury-vapor arc.

George H. Stine.

Culler, A. M. War injuries of the eye. *United States Naval Med. Bull.*, 1943, v. 41, Nov., pp. 1557-1564.

The author reviews 118 cases treated in a Naval Base Hospital in the South Pacific. He emphasizes the similarity of the problems that confront the ophthalmologist in civilian and military practice. Although errors of refraction and ocular diseases such as iritis and corneal ulcer seem relatively minor conditions, they are responsible for incapacitation in 9/10 of the cases here reported. The most frequent war injuries are shrapnel wounds, which are usually binocular and multiple. Careful removal of the foreign bodies, sulfa drugs by mouth, atropine, 5-percent sulfathiazole ointment, and continued cold applications constitute the treatment recommended. The ocular injuries resulting from air raids include burns, blast injuries, and direct trauma. Burns are especially frequent in this war, because of the use of incendiary bombs. Immobilization of the lids by sutures and early skin grafts are recommended. Damage to the eyeball is frequent in all head injuries, especially those involving the cranial cavity. Choroidal tears and their frequent sequel, proliferative traumatic chorioretinitis, especially involving the papillomacular region, are often encountered. Mental stress and shock form an important ophthalmic element in battle casualties.

Charles A. Bahn.

Kemal, Tarkan. A case of encapsulation of a foreign body beneath the bulbar conjunctiva. *Göz Klinigi*, 1943, v. 1, Aug., p. 10.

The right eye was injured by a small fragment of a bullet 25 years ago. Inflammation lasted three months. When the eye could be opened again, the foreign body was visible beneath the conjunctiva near the caruncle. The foreign body remains in the same position. It had done no damage to the eye.

J. Igersheimer.

Knapp, Arnold. Retinal detachment and trauma. *Arch. of Ophth.*, 1943, v. 30, Dec., pp. 770-774; also *Trans. Amer. Ophth. Soc.*, 1943, v. 41.

Lyle, D. J. Eye manifestations of head injuries. *Jour. Amer. Med. Assoc.*, 1943, v. 123, Dec. 4, p. 873.

The author divides the traumas due to head injury into the main divisions of cerebral concussion, contusion, compression and laceration, hemorrhage, and skull fractures. The ophthalmologic manifestations are either sensory or motor disturbances. There may be oculomotor palsies, intraocular or extraocular, with fundus changes in a certain percentage of cases. The importance of the pupillary changes during the early and late stages, especially noted among the compressions, hemorrhages, and skull fractures, is stressed. The important pupillary reflexes which are variable during the course of the condition should not be masked by a cycloplegic, a weak, fleeting mydriatic being the choice for fundus examination. Fundus changes include arteriolar spasms with ischemia, venous congestion, edema of the disc, and choking in the more severe cases. Visual-field changes may remain as the result of irreparable damage to the visual system. (4 cases, 12 figures, discussion.)

George H. Stine.

Malabehar Peña, Carlos. Does fluorescent light cause injury to the eyes? *Bol. del Hosp. Oft. de Ntra. Sra. de la Luz*, 1942, v. 2, Jan.-April, pp. 21-23.

On the basis of figures furnished by the manufacturers, the author emphasizes the relative absence of heat rays in the light of the fluorescent lamp and the quantitative approximation of ultraviolet rays to those of daylight. He concludes that this type of lighting is

not prejudicial or dangerous for the human eye.

W. H. Crisp.

Rocco, Alfredo. Intraocular foreign body. *Arquivos Brasileiros de Oft.*, 1943, v. 6, Aug., pp. 127-131.

The patient's left eye was struck by a foreign body which seemed to originate in whirling movements imparted to a tape measure in the hands of a passer-by. A wound found in the region of the upper limbus was closed with two sutures. The vision was soon completely abolished. When the patient came for examination by the author the eye, which was completely blind, showed conjunctival chemosis, and a steady discharge from the wound. On account of the evident panophthalmitis, the eyeball was enucleated. Section of the enucleated globe showed in the vitreous a very large metallic object corresponding in shape to the protective cap commonly attached to the extremity of a tape measure. The foreign body measured 2 cm. in its long diameter. The author emphasizes the desirability of an X-ray examination in any such case. (References, 1 illustration.) W. H. Crisp.

Stewart, D. D. S., and Lloyd, J. P. F. Transient slitlamp appearances due to concussion by small particles. *Brit. Jour. Ophth.*, 1943, v. 27, Nov., pp. 483-485.

The slitlamp showed the appearance of small gray plaques in the form of wreaths about 2 mm. in diameter, at the level of Descemet's membrane and the endothelium, in an eye injured by "back-fire" from the breech of a rifle. The wreaths did not intersect and were not contangential in any instance. The plaques were visible 30 hours after injury but had disappeared 15 hours later.

Superficial foreign bodies were removed and the eye was entirely quiet a week after the injury, the visual acuity being 6/6 with correction. It is suggested that the gray flecks which constituted the wreaths were optical effects from local variation in the index of refraction. (2 illustrations.)

Edna M. Reynolds.

Stieren, Edward. Intraocular foreign bodies. *Jour. Amer. Med. Assoc.*, 1943, v. 123, Dec. 4, p. 880.

The author stresses the importance of a careful history, the immediate use of tetanus antitoxin, and location of the foreign body by ophthalmoscope and X ray. He advises immediate enucleation of an eye if the wound of entrance involves the ciliary body. He has discarded the use of the giant magnet in favor of the hand magnet, and deplors the use of the magnet as a diagnostic instrument. The posterior route is preferred wherever possible; detachment of the retina is not to be feared if the scleral incision is cauterized by the application of phenol or diathermic micropunctures. Some retained nonmagnetic foreign bodies, such as glass, may be well tolerated for years. Nonmagnetic metallic foreign bodies are dangerous and difficult to remove, phthisis bulbi resulting from loss of more than one fourth of the vitreous bulk or from extensive disturbance by instrumental manipulation. (Discussion.)

George H. Stine.

Tibbles, Sidney. Burn of cornea from molten wax. *Brit. Med. Jour.*, 1943, Oct., p. 547.

A patient complained of loss of sight after some wax flew between the eyelids while flicking out a lighted wax taper. The cornea appeared normal, but on examination through the loupe a



perfectly transparent layer of wax was seen covering two-thirds of the cornea as if a contact glass was lying on it. The cornea did not stain with fluorescein until after the wax was removed, whereupon most of the vision was restored. The erosion was superficial, only the epithelium being affected. It is reasonable to assume that a fine layer of vapor protected the cornea.

R. Grunfeld.

## 17

### SYSTEMIC DISEASES AND PARASITES

Carrasco y de Mier, M. **Ocular disturbances of dental origin.** Jour. Internat. College of Surg., 1943, v. 6, July-Aug., p. 322.

Carrasco y de Mier advises correction of all dental disease before operations involving the opening of the globe. Ocular infections may take place (1) by direct continuity, (2) indirectly through sinus disease, (3) by the vascular route, especially venous channels, or (4) as the effect of substances producing allergy. To date there is no proof of the transmission of infection through the lymphatics, but reflex nervous affections are common, and may result in ocular vasomotor and secretory changes. Eugene M. Blake.

Parsons, J. H. **Eye diseases in elderly patients.** The Practitioner, 1943, v. 150, June, p. 329.

This paper presents a brief survey of ocular conditions encountered in senile patients, including refractive changes, arcus senilis, miosis, incipient cataract (with controlled use of mydriatics for central opacities), and glaucoma. Of the vascular disturbances the author mentions thrombosis of the central vessels, and arteriosclerotic retinal changes. Benjamin Milder.

Spies, T. D. **The natural occurrence of riboflavin deficiency in the eyes of dogs.** Science, 1943, Oct. 22, p. 367.

In families showing deficiency diseases the household pets were often found to be emaciated and weak. Subsisting on table scraps mainly, such animals were suspected of having nutritional deficiencies. It was not uncommon to find black tongue in dogs. Recently eye symptoms similar to the ocular lesions of riboflavin deficiency in human beings were observed in dogs.

Four dogs from the homes of families suffering from deficiency were studied. Most marked was photophobia. Pronounced injection of the scleral and palpebral conjunctiva was present. The vessels were tortuous and unusually dilated. Slight rotary nystagmus was present. Along with these symptoms were those of pronounced black tongue. Slitlamp examination could not be made. Treatment with nicotinic acid and riboflavin promptly and completely relieved these animals. This suggested the presence of a mixed deficiency disease. Francis M. Crage.

Woods, A. C. **The influence of sensitivity and immunity on ocular tuberculosis.** Pennsylvania Med. Jour., 1943, v. 46, Aug., p. 1133.

The material of this article was covered in detail in the series published in the Archives of Ophthalmology from 1938 to 1942.

Desensitization of rabbits with tuberculo-protein markedly shortens and diminishes the severity of ocular tuberculosis. Thirty percent of a group of immune-allergic rabbits desensitized by frequent doses of tuberculin failed to develop ocular tuberculosis following the introduction of living tubercle bacilli. Five percent of the group in

which desensitization was stopped at the time of ocular inoculation failed to develop tuberculosis. Two percent of a control group of immune-allergic rabbits not desensitized failed to develop ocular tuberculosis. Incubation times for the reacting rabbits were 7, 4, and 2 weeks respectively.

Since, clinically, secondary ocular tuberculosis is frequently present in immune allergic states, the effect of a desensitization procedure after the establishment of a definite ocular tuberculosis was examined. Desensitization of rabbits which had a healed systemic tuberculosis was begun 17 days after inoculation of the eyes with tubercle bacilli. A marked focal reaction occurred in all the animals at the start of tuberculin therapy. The activity of the ocular process however gradually dropped in this group till at the end of the 22nd week only one was active in the treated group, while 12 were active in the control group (43 eyes each). At the end of five weeks only four of the treated group showed ocular tuberculosis, while 25 of the control group were active.

In rabbits, repeated intracutaneous

injection of tuberculin controls ocular sensitivity and exerts a favorable effect on tuberculous infection already present or subsequently produced.

Owen C. Dickson.

## 18

### HYGIENE; SOCIOLOGY, EDUCATION, AND HISTORY

Case, P. H. Recent advances in ophthalmology of interest to the general practitioner. *Southwestern Med.*, 1943, Sept., p. 213.

In discussing ocular chemotherapy the sulfonamides receive the entire attention of the author. The surgical advances include corneal sutures and intracapsular extraction. Sodium-pentothal general anesthesia has helped in the highly nervous and in so-called "bad actors."

Advances in the treatment of squint, aniseikonia, avitaminosis, and color blindness are discussed. Orthoptics seems to be of proved value and is being more generally accepted. Preventive measures are being increasingly employed in industrial ophthalmology.

Francis M. Cragé.

## NEWS ITEMS

Edited by DR. DONALD J. LYLE  
904 Carew Tower, Cincinnati 2

News items should reach the editor by the twelfth of the month

### DEATHS

Dr. Lee Cohen, Baltimore, Maryland, died December 31, 1943, aged 69 years.

Dr. Gordon H. Bahlman, Flint, Michigan, died December 22, 1943, aged 56 years.

Dr. Robert B. Dibble, Pueblo, Colorado, died December 29, 1943, aged 69 years.

Dr. William S. Wentzel, Sunbury, Pennsylvania, died December 1, 1943, aged 54 years.

Dr. John A. Fell, Doylestown, Pennsylvania, died January 4, 1944, aged 93 years.

Dr. Anders E. Johnson, Watertown, Pennsylvania, died December 30, 1943, aged 72 years.

Dr. William B. Beaumont, Laceyville, Pennsylvania, died December 22, 1943, aged 78 years.

Dr. Jesse F. Gamble, Lincolnton, North Carolina, died December 24, 1943, aged 65 years.

Dr. William W. Pearson, Des Moines, Iowa, died February 11, 1944, aged 74 years.

Dr. Jonas Clark, Gilroy, California, died December 30, 1943, aged 90 years.

Dr. John W. Conklin, Leitchfield, Kentucky, died November 10, 1943, aged 85 years.

Dr. William H. Oatway, Sr., Waukesha, Wisconsin, died January 2, 1944, aged 73 years.

Dr. Charles C. Rankin, Philadelphia, Pennsylvania, died recently, aged 71 years.

Dr. Michel M. Saliba, Wilson, North Carolina, died January 5, 1944, aged 68 years.

Dr. Joseph W. Straight, Santa Ana, California, died December 25, 1943, aged 75 years.

Dr. John W. Millette, Dayton, Ohio, died December 28, 1943, aged 79 years.

Dr. Edwin M. Rodenberger, Macedon, New York, died December 19, 1943, aged 83 years.

Dr. Frederick Parks Steck, Shamokin, Pennsylvania, died December 23, 1943, aged 75 years.

Dr. Harry H. Ainsworth, Birchwood, Wisconsin, died January 8, 1944, aged 71 years.

Dr. Alexander C. Blair, Pittsburgh, Pennsylvania, died January 4, 1944, aged 74 years.

Dr. John P. Williams, Lincoln, Nebraska, died December 13, 1943, aged 70 years.

Dr. Carl F. Schaub, Chicago, Illinois, died January 7, 1944, aged 41 years.

Dr. Major H. Worthington, Chicago, Illinois, died February 27, 1944, aged 64 years.

Dr. James Munsie, Cleveland Heights, Ohio, died January 18, 1944, aged 76 years.

Dr. Thomas E. Presley, Clovis, New Mexico, died January 6, 1944, aged 73 years.

Dr. Carl Koller, New York, New York, died March 21, 1944, aged 86 years.

### SOCIETIES

The Reading Eye, Ear, Nose, and Throat

Society, Reading, Pennsylvania, held a joint meeting with the Philadelphia Laryngological Society, January 19, 1944, in Philadelphia. Included in the program was a paper by Dr. James E. Landis of Reading on "Why we should organize a Pennsylvania Academy of Ophthalmology and Otolaryngology."

The Brooklyn Ophthalmological Society held its regular meeting February 17, 1944. The guest speaker was Dr. Donald J. Lyle of Cincinnati who presented a paper on "Diagnosis of visual losses with normal fundi." The discussers included Dr. Abraham M. Rabiner, Dr. E. Jefferson Browder, and Dr. Ralph I. Lloyd.

At the meeting of the Cleveland Ophthalmological Club on February 15th, Dr. William Thornwall Davis spoke on the "Diagnosis and treatment of accommodative squint."

The Washington, D.C., Ophthalmological Society held its meeting on March 6th at the District of Columbia Medical Society Building. The guest speaker was Dr. Ramón Castroviejo of New York City who discussed "Keratetectomies and conjunctival plastics." A report on "A case of Coats's disease" was made by Dr. H. C. McKnew. Also included in the program were the following case presentations: "Circinate retinitis" by Dr. Bernard J. Gurwin; "Laceration of the globe" by Dr. Thomas R. Rees; "A case of plastic prosthesis" by Dr. Ernest Sheppard; and "Neurofibroma of the eyelid" by Dr. Inez E. Wilber.

On January 26, 1944, the Reading Eye, Ear, Nose, and Throat Society had as its guest speaker, Dr. Henry S. Ruth of Merion, Pennsylvania, president of the American Board of Anesthesiology, who spoke on the developments of the various Specialty Boards as well as the future in anesthesiology. This meeting was attended by all diplomates of Specialty Boards residing in Berks County.

Among the speakers at the symposium sponsored by the industrial health committee of the Utah State Medical Association on January 19th was Major John E. L. Keyes (MC), A.U.S. The subject of his paper was "Ophthalmology in industry."

Dr. William Thornwall Davis gave a paper on "Differential diagnosis of paresis of the right superior oblique or left superior rectus"

before the New York Academy of Medicine on February 21, 1944, in New York City.

The annual postgraduate industrial, medical, and surgical conference of the Michigan State Medical Society will be held on April 6th at the *Horace A. Rackham Educational Memorial* in Detroit. Dr. Melvin H. Pike of Midland will speak on "Eye pathology due to exposure to organic solvents."

There will be a meeting of the Association for Research in Ophthalmology, Inc., in June of this year. The meeting will be held at the Sherman Hotel in Chicago just prior to the meeting of the American Medical Association; namely, on June 13, 1944.

Any member wishing to present a paper or contribute to the program is requested to com-

municate with Major Brittain F. Payne, The School of Aviation Medicine, Randolph Field, Texas.

An interesting meeting with a varied program is anticipated, and all members who are able to attend are urged to do so.

#### PERSONALS

Among those on whom a full professorship was conferred by the Emory University School of Medicine, Atlanta, Georgia, was Dr. Grady E. Clay, professor of ophthalmology.

Copies of Bielschowsky's "Lectures on motor anomalies," second edition, can be obtained from the Dartmouth College Publications, at Hanover, New Hampshire, price \$1.50, postpaid.

## LEIOMYOMA OF THE IRIS\*

## A CASE REPORT

WILLIAM THORNWALL DAVIS, M.D., ERNEST SHEPPARD, M.D.,  
AND WALTER J. ROMEJKO, M.D.  
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Duke-Elder<sup>1</sup> referring to myomata states, "In the iris, they usually form sharply circumscribed tumors, appearing as yellowish-gray nodules without clinical symptoms, which grow slowly and are relatively benign, but if not completely excised, may recur (Verhoeff, 1936). Clinically, a myoma is quite indistinguishable from a malignant melanoma and for this reason the eye has usually been enucleated.

"While a myoma is impossible to diagnose clinically, its pathological recognition is by no means easy. The neoplasm is characterized by closely packed bundles of long, spindle-shaped cells with an eosinophilic cytoplasm and rod-shaped nuclei arranged in palisade-like rows (Fig. 2040): these are bound together with myoglia fibrils coursing along the cells and coalescing to form large fibers at their terminal processes (Fig. 2041). The picture resembles a spindle-celled malignant melanoma, the difference being that the cells of the latter are rarely distinctly spindle-shaped but terminate in and send off laterally, ill-defined processes anastomosing with those of neighboring cells to form a syncytium.

"It is only possible to distinguish be-

tween the two by differential staining (Mallory's phosphotungstic haematoxylin) and by the demonstration of the myoglia fibers by gold impregnation; and since these methods are comparatively recent, the cases reported by the older writers must be viewed with suspicion. The only three to be unquestionably demonstrated are those of Verhoeff (1923), Frost (1937), and Ellett (1939) (Fig. 2042). They seem to be associated with the sphincter muscle."

In Verhoeff's<sup>2</sup> case, the tumor was removed, apparently completely, on May 21, 1904. When the eye was dressed the next day it was found that a large portion of the tumor remained, giving the impression that none had been removed. Further attempts at removal with forceps and suction were unsuccessful. The eye was not enucleated until May 19, 1920, 16 years after the original operation. This was the first case in which the tumor was demonstrated by special staining. Of interest is its slight malignancy in that there was no material increase for 16 years. It arose from the surface of the iris by a constricted base and remained alive in spite of the fact that it was completely severed from the iris; its new blood vessels were derived from the wound. The original tumor did not invade the iris stroma nor involve the filtration angle. Histologically it showed no mitosis.

Frost's<sup>3</sup> case is the second "In which

\* From the Department of Ophthalmology, George Washington University Medical School. Read in part before the Washington, District of Columbia, Ophthalmological Society, February 15, 1943.

the pathologic findings are sufficiently definite to justify this diagnosis." The eye had been examined periodically for six years, prior to the tumor's appearance in August, 1934, and was enucleated in March, 1935, because several consultants thought the tumor was a sarcoma.

Ellett's<sup>4</sup> case had had an irregular pupil for 5 years prior to the appearance of the tumor, which was of 15 years' duration. This eye also was enucleated because the tumor clinically resembled sarcoma.

Van Heuven<sup>5</sup> has reported a case of leiomyoblastoma of the iris, and Was-senaar<sup>6</sup> has reported a case of leiomyoma of the upper lid.

Collins and Mayou<sup>7</sup> state, "The points relied on in diagnosing these growths as myomata rather than spindle-celled sarcomata have been: the position in which they started, their slow rate of increase, the similarity in the shape and size of their cells to unstriated muscle fibers and the rod shaped appearance of their nuclei."

Reëxamination of Zentmayer's<sup>9</sup> case proved it to be a leiomyoma.

#### CASE REPORT

M. L., a woman, aged 27 years, was first examined on November 16, 1942, when she complained of a brown spot in the iris of the right eye which had been present as long as she could remember. She had injured the eye with a wire when a child, but of this there was no evidence. The history suggested a superficial scleral injury. The family history was irrelevant.

The ocular examination was essentially normal except for the tumor in the inferior temporal quadrant of the right iris, as shown in figure 1a. The physical examination by Dr. Lewis Ecker was normal. There was no evidence of primary tumor elsewhere. The blood Wassermann and Kahn tests were negative. There was 4 percent of eosinophiles, otherwise the hemogram was normal.

The tumor and adjacent iris tissue was removed on January 5, 1943 (fig. 1b). The postoperative course was uneventful. Pathologic reports were made by Col. J. E. Ash, Army Medical Museum, accession 87990, as follows:

"Gross: the specimen consists of a pale fibrous mass measuring 9 by 6 by 3 mm. There is an opaque elevated nodule 3 mm. in diameter on the anterior surface and brown pigment on the posterior surface.

"Microscopic: The tumor is composed of interlacing fascicles of non-pigmented, spindle-shaped cells with long fibrillar processes of smooth muscle character and oval, sometimes nucleolated nuclei. There is no evidence of intercellular collagen. The bundles of tumor cells are divided by an interlobular, richly vascular connective tissue stroma. The vessels are generally thin-walled but not of the sarcoma type. The tumor probably arises from iris muscle. Diagnosis: Leiomyoma; iris" (fig. 2).

#### SUMMARY

1. Leiomyoma of the eye and its adnexa is rare. Cases have been reported involving the iris, ciliary body, and upper lid.

2. Of clinical importance is its slow growth and long duration, the absence of symptoms, the lack of any tendency to invade the surrounding structures or the filtration angle. With these characteristics it would seem advisable to consider excision before enucleation.

3. It is clinically impossible to differentiate leiomyoma from malignant tumors of the iris.

We wish to express our appreciation to Heleanor Campbell Wilder for kind cooperation in expediting the examination of the specimen and to Mr. Roy Reeves of the Army Medical Museum for preparation of the microscopic illustration.

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## SUPPRESSION AMBLYOPIA\*

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Although considerable attention has been paid to the subject of amblyopia, uncertainty remains with regard to its status. Views on its relation to squint have traversed the length of the pendulum's arc, as shown by Peter's<sup>1</sup> statement that "amblyopia in the squinting eye was formerly regarded as one of the causes of monocular squint but the lowered vision which is found is now interpreted as a symptom of squint and not as its cause." Conclusions drawn from a careful observation of amblyopia in patients with and without squint do not agree with either extreme. For this reason a statistical study was made of 200 consecutive amblyopic patients at the Barnes General Hospital.

The term "amblyopia" refers to a functional disorder characterized by a reduction of visual acuity which is not correctible to normal by optical means. Fuchs<sup>2</sup> has classified the conditions denoted by the term as follows: 1. Disturbances of sight seated in the eye itself—(a) congenital amblyopia, (b) ambly-

opia ex anopsia. 2. Disturbances of sight of central origin.

This classification has been used for many years but has several obvious flaws. First, there is considerable clinical evidence that so-called amblyopia ex anopsia is not seated within the eye itself but is of cerebral origin. The process of visual interpretation or "seeing" takes place in the brain, so any inhibition of the retinal image must be cerebral. Second, the term congenital amblyopia has been used to designate a condition which, according to Fuchs, "we assume to exist in those cases in which weak sight has existed for a long time, and in which all other causes for it can be excluded." In most of these cases the amblyopia would better be considered idiopathic. Third, Fuchs used the term amblyopia ex anopsia for amblyopia from nonuse resulting from such obstacles to vision as opacities in the cornea, lens, or pupil (pupillary membrane), or from disuse occurring in eyes affected with high refractive errors or squint since childhood. The amblyopia resulting from congenital opacities in the ocular media is not the same as that occurring in eyes

\* From the Eye Clinic, Barnes General Hospital.



without pathology since it has been shown that the macula may not develop normally without the stimulus of the retinal image. In these cases the vision usually remains poor no matter how early the cataract is removed even after bilateral operations. If this type of amblyopia were acquired it would be expected that the vision would improve in one eye of patients operated on for bilateral congenital cataracts. In individuals with cataract acquired later in life the visual acuity usually is correctible to normal upon removal of the cataract even if the visual obstacle has been present for many years. The amblyopia due to congenital visual obstacles would more properly be termed *congenital amblyopia*.

A fourth possible objection to Fuchs's classification is the use of the term *ex anopsia*, meaning "due to not seeing" or "due to disuse." The question of its justification will be considered after a presentation of the results found in my series of amblyopic patients.

Abraham<sup>3</sup> has presented the following classification which is based on his view that the term *ex anopsia* is a misnomer and that suppression is the important factor. A. Congenital amblyopia. B. Acquired amblyopia: 1. Passive suppression (ametropic)—(a) bilateral; (b) unilateral. 2. Active suppression—(a) bilateral; (b) unilateral (squint).

Although I agree entirely with the use of the term suppression rather than *ex anopsia* there are certain objections to this classification. First, the same comment referred to in criticizing Fuchs's classification applies to the use of the term congenital amblyopia when idiopathic amblyopia is meant. Second, I do not believe bilateral-suppression amblyopia exists except in patients with hysterical amblyopia. The term suppression refers to a psychologic inhibition of the retinal image. When suppression becomes habitual, amblyopia is the result. Patients may have

alternating suppression, as in patients with alternating strabismus, but amblyopia occurs only in one eye. Occasionally one sees a person with a high hyperopia which cannot be corrected beyond 20/40 in each eye; but this is a matter of lack of discrimination rather than suppression. It is frequent in young children to find a lower visual acuity than is commensurate with the refractive error. These same children later have normal visual acuity. At any rate, I do not believe subgrouping as to involvement of one or both eyes is justified. Third, Abraham considered passive suppressive amblyopia as due to lack of correction, or late correction of refractive error, and active suppression amblyopia as due to uncomfortable or confused binocular fixation. Whether such a subdivision is justifiable is another of the questions for which an answer is sought in the present study.

A classification which I believe more adequately divides the various types of amblyopia is simply:

- (1) Suppression amblyopia (so-called amblyopia *ex anopsia*)
- (2) Idiopathic amblyopia
- (3) Congenital amblyopia (due to congenital visual obstacles)
- (4) Discrimination amblyopia (bilateral)
- (5) Hysterical amblyopia
- (6) Amblyopia of toxic and neurologic disease

Only the first two groups concern us here.

## RESULTS

Of a total of 200 consecutive amblyopic patients 124 had no deviation even under cover, 63 were or had been convergent squinters, 8 were divergent squinters, and 5 had very fine corneal opacities which were in themselves not sufficient to account for the reduced visual acuity. Each group was subdivided into the following

categories, according to the refractive error found under homatropine cycloplegia:

- (1) Anisometropia of at least 1.50 diopters of sphere, 1.50 diopters of cylinder, or both;
- (2) High isohyperopia or isoastigmatism;
- (3) Low refractive error or emmetropia.

The value chosen as the criterion of anisometropia was entirely arbitrary. It appeared more reasonable than the 0.5 diopters used by Worth and Lagleyze.<sup>4</sup> This, of course, makes a great deal of difference in the final statistical breakdown. Clinically an anisometropia of 0.75D. often causes discomfort, but suppression apparently does not occur unless the difference is 1.50 to 2.00 diopters.

#### I. AMBLYOPIA WITHOUT SQUINT

The group of 124 nonsquinting amblyopic patients was divisible according to the following refractive conditions:

- (1) Anisometropia 94 (75.8 percent)
- (2) High isohyperopia or isoastigmatism 18 (14.5 percent)
- (3) Low refractive error or emmetropia 12 (9.7 percent)

The anisometropia averaged 3.40 diopters of spherical difference in 69 cases and 4.02 diopters of anisoastigmatism in 25 cases. In those cases where both spherical and astigmatic anisometropia was present, only the higher of the two was considered. The remaining 30 patients had a difference in correction of less than 1.50 diopters of sphere, cylinder, or both. Of these 17 with high isohyperopia averaged 5.05 diopters of hyperopia in the amblyopic eye and 4.49 diopters in the nonamblyopic eye. The astigmatic correction in one case of isoastigmatism was 2.75 diopters each eye. The 12 patients with low refractive error averaged 0.99 diopter of spherical error in the

TABLE 1

REFRACTIVE CORRECTION IN 98 CASES OF NONSQUINTING AMBLYOPIA

No.	Age	Amblyopic Eye		Nonamblyopic Eye (Corrected Vision 20/20 Each) Correction (Cycloplegic)
		Cor- rected Vision	Correction (Cycloplegic)	
1	22	20/200	+6.00+0.50×18	+1.25
2	32	20/200	+5.50	+4.00
3	25	C.F. 1'	-11.50+2.75×110	-1.50
4	22	20/200	+5.25+3.00×70	+1.25+1.25×75
5	23	20/100	+5.00+1.50×20	+1.00
6	21	20/100	+4.00+0.50×85	+2.50+1.00×85
7	21	20/200	+1.00+1.25×90	-0.50+0.25×90
8	24	20/100	+2.75	+0.75
9	21	20/200	+5.50+1.00×75	+4.50
10	24	9/200	+3.50	+0.50
11	22	8/200	+4.50	+1.00
12	40	20/200	+4.50+0.75×115	+1.25+0.50×90
13	26	20/200	-3.50+5.50×105	+1.50×60
14	21	10/200	+3.25+1.00×120	0
15	20	20/60	+3.50	+1.50
16	21	H.M.	+3.00	+0.75
17	22	C.F.	+5.00+3.25×75	+4.75+4.00×97
18	21	6/200	+6.00+1.00×120	+1.50
19	45	2/200	-2.50+8.00×125	+1.00+0.25×180
20	23	20/100	+0.75	+0.75
21	21	C.F.	-3.50+6.25×80	+1.00
22	22	20/200	+1.75+5.00×75	+1.00+0.25×90
23	27	20/200	+6.00	+5.50
24	34	20/200	+0.75	+0.50
25	22	C.F.	+6.00+2.25×100	+1.00
26	21	4/200	+5.00+1.25×90	+0.50
27	23	5/200	+3.75+1.25×90	+3.00+1.00×90
28	22	5/200	+7.50+0.50×90	+1.25
29	21	20/100	+1.25	+1.25
30	29	20/100	+4.75	+2.75+0.37×90
31	22	8/200	+4.50+3.25×60	+1.00+0.12×75
32	33	20/200	+6.00+1.00×180	+3.50+1.75×180
33	38	3/200	+1.00	+0.50+0.25×30
34	22	20/70	+3.25	+0.25×180
35	22	20/200	+4.75+1.25×165	+0.75
36	29	20/200	+8.00+0.37×165	+7.00
37	22	3/200	-3.50+0.50×45	+0.75+0.87×5
38	21	20/100	-3.00+6.00×85	-2.50+1.00×90
39	24	20/100	+5.75+1.00×110	+1.50
40	31	C.F.	+4.00+0.75×95	+1.75+0.37×70
41	20	20/40	+3.75+1.50×95	+1.00
42	24	20/100	+4.25+0.75×90	+3.50+0.50×80
43	25	20/400	+3.50+2.00×90	+0.75
44	20	20/40	+1.50+5.00×75	+0.75+0.25×90
45	19	20/400	+3.00+0.75×160	+0.25
46	—	20/100	+2.50+1.75×90	+0.50+1.00×75
47	30	C.F. 6'	+3.25+2.25×75	+0.25+0.37×75
48	23	20/40	+4.25+1.75×90	+1.50+1.25×95
49	25	20/200	+4.00+3.75×105	+3.25+0.87×80
50	21	6/400	+6.00+1.00×120	+0.50+0.37×90
51	32	20/200	+1.50+1.12×58	+0.75+0.37×105
52	22	L.P.	+1.50	+0.75+0.12×85
53	11	20/200	-3.50+2.25×15	-1.25+1.25×180
54	25	20/200	-3.50+8.00×105	+0.50+0.62×90
55	25	20/200	+5.00	+1.00+0.50×92
56	26	20/100	+3.75	+1.75
57	21	20/70	+3.00+1.25×90	+1.00+0.50×80
58	22	C.F.	+5.00+0.50×90	+0.75
59	36	L.P.	+6.50	+2.50+0.37×90
60	18	20/100	-1.50	+0.50+0.25×90
61	45	20/40	-2.00+3.75×135	+0.25+0.25×30
62	25	20/40	-2.50+3.50×140	-1.50+0.50×5
63	20	20/60	-2.50+3.50×105	+1.50×90
64	20	15/200	+3.00	+1.00+0.50×90
65	27	10/200	+4.50+0.25×180	+1.00
66	28	20/200	+3.00+3.25×75	+4.00+1.00×95
67	31	4/200	+4.50+2.50×55	+1.00
68	41	2/200	+7.00+1.00×180	+5.75+0.50×180
69	28	5/200	+6.25	+1.00+0.25×90
70	27	20/200	+3.50+0.50×10	+4.75
71	18	5/200	+6.50+1.50×130	+1.00
72	28	C.F.	+4.50+1.25×100	+2.50
73	19	3/200	+6.50+1.00×110	+4.25
74	24	20/200	+3.25+1.50×80	+0.75×85
75	46	20/30	-0.75+3.25×75	+1.25+0.37×75
76	25	20/70	+4.25	+1.50
77	26	20/70	+8.00+2.00×70	+7.25+2.00×100
78	22	20/50	+5.50+0.25×75	+3.00+0.75×125
79	25	4/200	-5.25+5.50×90	+0.75+0.75×100
80	23	5/400	+3.50+1.00×90	+3.75+0.50×115

TABLE 1 (Continued)

No.	Age	Amblyopic Eye		Nonamblyopic Eye (Corrected Vision 20/20 Each) Correction (Cycloplegic)
		Corrected Vision	Correction (Cycloplegic)	
81	32	H.M.	+1.00	+0.37×115
82	24	20/200	-1.25+1.00×40	+0.50+0.37×105
83	23	15/400	+6.00	+5.00
84	26	20/200	+2.75×75	+2.75×88
85	22	20/60	+1.12+2.75×85	+0.25+0.12×35
86	28	8/200	+6.50+1.00×90	+1.00
87	21	4/400	-8.00+1.00×95	-0.50+0.62×95
88	44	20/60	+3.00+0.62×110	+1.00+0.37×60
89	22	4/200	+4.75	+3.75
90	22	20/200	+0.75+5.50×80	+0.75+0.62×105
91	18	20/80	+1.25+4.00×100	+1.25+0.37×90
92	34	20/100	+0.75+0.25×90	+0.25+0.37×175
93	20	20/200	+5.25+0.50×100	+0.50+1.12×80
94	—	20/100	+2.00+0.62×95	+0.75+0.25×80
95	20	20/400	+3.00	+0.50
96	21	H.M.	+5.00+0.50×90	+3.00+1.00×80
97	24	H.M.	+6.00+1.50×85	+1.00+0.62×180
98	20	10/200	+5.50+0.25×15	+5.00
99	21	20/50	-2.75+5.00×85	-1.25+1.75×97
100	26	20/50	-2.50+3.50×90	0
101	35	20/200	+1.75+2.25×90	0
102	35	20/400	+5.50+3.50×103	+1.25+0.25×15
103	20	20/200	+2.00+0.75×75	+1.50+0.62×95
104	22	20/200	+0.75	+0.50
105	22	20/50	-2.50+3.50×15	-0.50+0.75×180
106	—	C.F.	+4.00+0.25×45	+1.50
107	19	3/200	+4.75+3.50×92	+1.50+0.50×90
108	24	3/200	+2.00+5.25×77	+0.75
109	27	3/200	-3.00+5.00×100	+0.50
110	23	C.F.	+4.75+5.50×80	+0.75+0.62×105
111	22	20/200	+4.00+1.75×75	+0.75
112	42	20/70	-8.00+1.00×90	0
113	24	20/200	-5.00+4.00×15	-1.25
114	26	3/200	+3.00+1.75×165	+0.75+0.87×5
115	20	20/400	+4.00×80	+0.50+1.00×105
116	22	20/40	+3.25	+1.00+0.50×85
117	18	20/400	+0.25×90	+0.25×90
118	23	20/60	+5.50+1.50×90	+1.50
119	20	20/200	+3.25+1.25×70	4.25
120	51	20/70	-0.75+0.75×85	-1.50+1.00×90
121	18	20/40	+6.00+1.50×50	+4.75+1.25×165
122	30	20/400	+5.75+1.25×90	+0.75+1.25×5
123	26	20/100	+3.00+2.50×95	+0.25+1.00×75
124	19	20/70	+5.50+2.25×10	+5.25+0.75×180

amblyopic eye and 0.65 diopter in the nonamblyopic eye. One of these patients had had the amblyopic eye patched for eight weeks during childhood because of lid disease. In this group suppression of the intermediate as well as of the central field of the squinting eye was present in those with less than 20/50 visual acuity (corrected) in the amblyopic eye. The tests were made with a stereoscope and Guibor cards.

## II. AMBLYOPIA WITH CONVERGENT SQUINT

This group of 63 patients was affected only by comitant squints, some of which may have been precipitated by ocular pareses. They were separable into the following categories:

- (1) Anisometropia 18 (28.6 percent)
- (2) High isohyperopia or isoastigmatism 29 (46.0 percent)
- (3) Low refractive error or emmetropia 16 (25.4 percent)

The anisometropia averaged 2.94 diopters of spherical difference in 16 cases and 4.12 diopters of anisoastigmatism in 2

TABLE 2  
REFRACTIVE CORRECTION IN 51 CASES OF  
AMBLYOPIA WITH CONVERGENT SQUINT

No.	Age	Amblyopic Eye		Nonamblyopic Eye (Corrected Vision 20/20 Each) Correction (Cycloplegic)
		Corrected Vision	Correction (Cycloplegic)	
1	—	20/100	+3.50+0.50×95	+3.75+1.00×75
2	21	20/100	0	0
3	38	H.M.	+4.00	+4.00
4	28	H.M.	+2.25	+1.25
5	21	20/200	+1.50	+0.50+0.25×90
6	24	C.F.	-10.00	-0.50+1.00×90
7	26	20/200	+2.50+1.00×50	+2.00+0.50×110
8	21	C.F.	+1.25	+0.75
9	20	C.F.	+0.50	-0.25
10	22	20/100	+1.25+1.00×90	+1.25+1.00×90
11	21	10/200	+3.50	+0.75
12	21	6/200	+1.25	+0.75
13	21	3/200	+5.00+1.00×90	+0.75
14	25	20/100	+1.75	+0.50
15	21	20/100	+2.75+0.75×90	+1.00
16	22	20/200	+3.25+1.25×160	+1.25+0.87×50
17	27	20/200	+3.00+0.75×90	+2.50+0.50×180
18	20	20/200	+1.25	+0.50
19	—	20/100	+6.25+0.25×20	+6.00+0.25×180
20	21	20/50	+3.75+3.00×165	+4.00+0.75×75
21	—	20/60	+0.50	+0.75
22	26	20/200	+0.50+0.25×90	+0.75
23	36	H.M.	+7.75	+2.50+0.25×90
24	27	20/200	+3.50+0.50×90	+3.00+1.00×100
25	37	L.P.	+3.00	+2.00+0.25×200
26	38	20/300	+4.25+1.75×180	+4.25+1.00×10
27	21	20/200	+4.25+2.50×75	+3.75+2.50×102
28	22	10/200	+4.50+2.25×45	+3.50+1.75×120
29	26	4/400	+2.00+2.00×85	+1.25+1.12×85
30	26	H.M.	+1.75	+1.00
31	18	20/400	+3.25	+2.50+0.75×110
32	23	20/100	+2.50+0.75×75	+3.00+0.62×63
33	27	C.F.	+3.50+3.00×85	+3.50+2.00×95
34	28	20/200	+5.25	+2.75
35	27	10/200	+5.25+0.25×15	+6.00+0.25×165
36	26	H.M.	+0.50+2.75×90	-0.25+2.25×105
37	22	4/200	+0.50+4.00×180	+0.50
38	28	20/300	-1.50+1.25×135	+0.75
39	33	L.P.	+2.00	+1.75
40	21	20/60	+3.00	+1.00+0.25×135
41	—	20/80	+1.00+0.37×70	+1.00+0.62×105
42	24	10/400	+6.50+1.50×90	+4.50+0.25×90
43	27	20/200	+4.50+0.50×180	+4.25+0.75×180
44	5	10/200	+5.00	+4.50
45	24	20/200	+0.50	+0.50
46	49	20/400	+2.00+0.25×180	+2.00+0.25×180
47	25	20/200	+3.00+0.50×105	+1.25
48	26	20/60	+4.00	+5.00+0.50×180
49	22	20/100	+6.25+0.37×75	+6.75+0.37×120
50	19	C.F.	+2.00+0.25×105	+3.25+1.12×25
51	22	C.F.	+6.00+0.50×165	+3.25+1.37×25
52	19	L.P.	+0.50+0.50×90	+0.75
53	21	20/20	+3.00+0.50×175	+0.75+0.87×165
54	28	20/60	+2.75+0.50×90	+1.00+0.37×90
55	26	L.P.	+1.50+5.25×100	+4.75+1.00×90
56	25	20/200	+8.00	+4.75+0.25×150
57	20	20/100	+4.50+1.50×100	+4.75+0.50×90
58	24	H.M.	+5.50	+5.50+0.25×120
59	18	C.F.	+4.00	+0.75+0.50×95
60	27	20/400	+3.75+2.00×180	+3.25+0.62×50
61	25	20/300	+6.75+0.75×90	+5.50+0.75×115
62	31	20/200	+1.50	+0.25+0.75×90
63	24	20/70	+0.50	-0.25

cases. The remaining 45 patients had a difference in correction of less than 1.50 diopters of sphere, cylinder, or both. Of these, 28 had high isohyperopia averaging 3.83 diopters in the amblyopic eye and 3.67 diopters in the nonamblyopic eye. A single case of high isoastigmatism required a correction of 2.75 diopters of

The anisometropia averaged 3.81 diopters of spherical correction in four cases and 3.37 diopters of astigmatic correction in two cases. The two patients with low refractive error averaged 0.87 diopter of spherical correction for the amblyopic eye, and 0.50 diopter in the nonamblyopic eye.

TABLE 3  
REFRACTIVE CORRECTION IN 8 CASES OF  
AMBLYOPIA WITH DIVERGENT SQUINT

No.	Age	Amblyopic Eye		Nonamblyopic Eye (Corrected Vision 20/20 Each) Correction (Cycloplegic)
		Cor- rected Vision	Correction (Cycloplegic)	
1	23	20/70	-0.25	+0.25
2	22	20/200	+0.75 +5.25×80	+1.00
3	21	H.M.	+7.00	+1.00
4	45	6/200	-5.50	+0.50
5	39	20/100	+3.75 +2.25×30	+1.25 +0.50×165
6	22	20/70	+0.25	-1.50
7	24	20/70	-1.50 +1.75×105	-0.50 +0.25×180
8	26	20/400	+1.50	+0.75

cylinder in the amblyopic eye and 2.25 diopters in the nonamblyopic eye. The remaining 16 patients with low refractive error or emmetropia required an average of 0.96 diopter of spherical correction for the amblyopic eye and 0.60 diopter for the nonamblyopic eye.

### III. AMBLYOPIA WITH DIVERGENT SQUINT

This group consisted of only eight pa-

### IV. AMBLYOPIA WITH FINE CORNEAL OPACITIES

This group consisted of five patients, four nonsquinting and one with divergent squint. All were believed to have had good visual acuity in both eyes before the occurrence of corneal ulcer. They are separable as follows: (1) Anisometropia 4 (80 percent); (2) Low refractive error 1 (20 percent).

The anisometropia averaged 2.70 diopters of astigmatic difference in three cases and 2.50 diopters of spherical difference in one case. The single patient with low refractive error required 1.75 diopters of spherical hyperopic correction in the amblyopic eye and 1.00 diopter in the nonamblyopic eye.

The results may be summarized as follows:

	Anisometropia	High Isohyperopia or Isoastigmatism	Low Refractive Error
	no. percent	no. percent	no. percent
124 Nonsquinting amblyopia	94 (75.8)	18 (14.5)	12 (9.7)
63 Amblyopia with convergent squint	18 (28.6)	29 (46.0)	16 (25.4)
8 Amblyopia with divergent squint	6 (75)		2 (25)
5 Amblyopia with fine corneal opacities	4 (80)		1 (20)
Total	122 (61)	47 (23.5)	31 (15.5)

tients, separable into two groups: (1) Anisometropia 6 (75 percent); (2) Low refractive error 2 (25 percent).

### COMMENT

Of the series of 200 amblyopic patients, the condition of those (15.5 percent)

without significant refractive error may be considered as idiopathic. The discussion to follow will concern only the remaining group of 169 with significant refractive error.

If one considers the two large groups of the nonsquinting amblyopic and the amblyopic with convergent squint it is apparent that the chief difference is the predominance of anisometropia among the nonsquinters and of isometric high hyperopia or astigmatism among the convergent squinters. The anisometropia was

TABLE 4  
REFRACTIVE CORRECTION IN 5 CASES OF  
AMBLYOPIA WITH VERY FINE CORNEAL  
OPACITIES

No.	Amblyopic Eye Correction (Cycloplegic)	Nonamblyopic Eye Correction (Cycloplegic)
1	+0.25	-2.25+0.50×7
2	+0.50+3.50×115	+1.75
3	-0.25+2.75×60	+1.25+0.37×90
4	+1.75+1.12×45	+1.00+0.37×167
5(Diverg.)	-1.00+2.25×120	-0.50

more frequently spherical than astigmatic, in contrast to Abraham's findings.<sup>3</sup>

These findings suggest some causal relationships which must necessarily be largely theoretic. Our consideration depends in part on whether an eye must focus images sharply early in life to develop normally before the binocular reflexes develop. If this were true those infants whose eyes are highly astigmatic at birth would never be correctible to 20/20 with glasses later. If we assume that each visual element develops normally whether the image is sharp or blurred, then what Abraham calls passive suppression does not occur. With this assumption in mind let us consider anisometropia first. It must be agreed that aniseikonia exists in the uncorrected anisometropic. When the binocular reflexes begin to develop fusion is found to be difficult or uncomfortable. Psychologic inhibition of the disturbing macular image is resorted to. This process

is known as suppression. As time goes on the suppression becomes more diffuse. If one imagines the visual field as an island shown in cross-section, representing the horizontal meridian of the retina (Roenne and Traquair), suppression involves the vision in a manner such as to level off the macular peak and eventually to depress the entire field. The periphery of the temporal field is least affected since it is not overlapped by the field of the other eye. When suppression becomes habitual amblyopia results. Frequently suppression may be reduced by occlusion of the nonsuppressing eye. However, this is not permanent unless the factors causing the suppression are removed.

An interesting type of meridional suppression in astigmatic anisometropia was described by Martin.<sup>5</sup> He found the visual acuity in the meridian of greatest diffusion to be one half or one third of that in the opposite meridian.

The process of suppression in anisometropia is often observable in patients following operation for monocular cataract. For a short while after operation the patient is conscious of the larger blurred image from the eye that has been operated on. In a relatively short time it is suppressed but may be called into consciousness if proper correction is placed before this eye. The same process is experienced by microscopists and watchmakers who learn to suppress the macular impression from one eye, at first voluntarily and later unconsciously.

In cases of high isohyperopia or high hyperopic isoastigmatism another process apparently goes on. In these patients there is a need for great accommodative effort in order to get clear vision. As the binocular reflexes develop accommodation and convergence become associated. The convergence resulting from the desire for clear binocular vision causes a

diplopia that is very confusing. To avoid this, suppression takes place in the more ametropic eye. With habitual suppression, amblyopia results. The fact that isometric high hyperopia is most frequent among the convergent squinters fits in well with the accommodation-convergence theory just stated. In these cases convergence continues to be associated with accommodation even though amblyopia exists. This explains why the deviation in many cases of monocular convergent squint with amblyopia is reduced when convex lenses are worn. In other cases, if the hyperopia exceeds the ability of the accommodation to permit clear vision, no squint develops (Chavasse).<sup>4</sup> In my series of amblyopic patients the degree of hyperopia in those convergent squinters with isohyperopia was less (average of 3.83 diopters in the amblyopic eye and 3.67 diopters in the nonamblyopic eye) than in nonsquinters with isohyperopia (average of 5.05 diopters in the amblyopic eye and 4.49 diopters in the nonamblyopic eye).

In the cases of divergent squint, the majority were anisometropic. Suppression unquestionably preceded the amblyopia in these cases.

In the cases with fine corneal opacity the original ulcer had been present during early childhood. The suppression could have been produced either by the obstacle to vision at the early age or by the resulting change in refraction due to scarring, which usually produces anisometropia, particularly the astigmatic type.

During the period of binocular-reflex development, fusion may develop to various stages both in the anisometropic and in the high isohyperopic, but any sudden weakening factor such as shock or an acute infectious process may cause the attained level of fusion to be too difficult to sustain, so that recourse will be had to

suppression. This accounts for the abrupt onset of many cases of strabismus.

In many instances of comitant squint, suppression precedes the deviation, whereas in others (probably including those with abrupt onset associated with illness or shock) suppression follows diplopia; so suppression cannot always be considered a result of the squint. In any patient with a paretic extraocular muscle the resulting diplopia leads to secondary suppression. Many cases of comitant squint are probably of paretic origin. Thus suppression and amblyopia may *precede or follow* the development of squint. This type of amblyopia *always follows suppression* and should be designated properly as *suppression amblyopia* and not as "ex anopsia." The process is always an active one rather than simply a passive loss of acuity from neglect, which the term "ex anopsia" implies. For the same reason Abraham's subdivisions into active and passive types do not appear to be justifiable.

Further evidence that the development of amblyopia is an active process is shown by the presence of a central scotoma which may be either relative or absolute. Uththoff<sup>6</sup> found a scotoma in 55 percent of his cases whereas Heine observed it in 90 percent. Uththoff was convinced that central scotoma is constant in marked amblyopia. Evans, Peter, and Travers have done extensive work in this field. Best<sup>7</sup> demonstrated that during microscopy an absolute central scotoma was present, without any involvement of the peripheral field. The improvement by occlusion and the transfer of the amblyopia from the poor eye to the better one by occlusion are additional convincing observations. The transfer of amblyopia apparently is possible only during the first few years of life.<sup>8</sup> That the age factor is important is shown also by the fact that

amblyopia rarely occurs in squinting children if the squint develops after the age of seven. It explains the relative infrequency of amblyopia in cases of divergent squint, most of which develop later.

It is obvious that amblyopia may or may not be associated with squint. Most nonparetic squints probably result from *suppression* plus an *additional factor*, either the accommodative stimulus to convergence, or simply the assumption of the dissociated position by the suppressed eye. Idiopathic amblyopia must be considered as due to suppression resulting from such factors as patching one eye in infancy or childhood and possibly hemorrhages due to birth traumata.

#### CONCLUSION

1. In disagreement with Peter's statement that amblyopia in squinting eyes is a symptom of squint and not its cause, suggestive evidence has been presented indicating that suppression and amblyopia precede the development of certain nonparetic squints and follows the de-

velopment of other nonparetic squints and those of parietic origin.

2. Anisometropia is the predominating associated factor in nonsquinting amblyopic subjects, whereas high isohyperopia is the most frequent factor in cases of amblyopia with convergent squint.

3. Nonparetic squint probably requires suppression plus another factor for its development. This may be the accommodation-convergence relationship or simply the assumption of the dissociated position after suppression has been obtained in one eye. The age factor is obviously of considerable additional importance.

4. Suppression amblyopia is a more accurate term than amblyopia ex anopsia, implying, as it does, an active rather than a passive process.

5. The conclusions drawn may be of aid in adding links to the chain of evidence as to the cause of squint. Further clarification of the reason for normal muscle balance in a large number of amblyopic subjects, particularly a possible relationship to peripheral fusion, is necessary.

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## EXTRADURAL DIPLOIC EPIDERMIDS PRODUCING UNILATERAL EXOPHTHALMOS\*

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Unilateral exophthalmos presents one of the most challenging diagnostic problems in ophthalmology. Among the unusual causes of this condition are the extradural diploic epidermoids. Such tumors are not to be confused with the so-called oil cysts or cholesteatoma of the orbit.<sup>1</sup> While both arise embryologically as a result of identical developmental defects, the point of origin of the diploic epidermoid results in characteristic bony changes which should aid greatly in the diagnosis of this condition.

In the neurosurgical literature the occasional reports describing these tumors have been collected by Bailey,<sup>2</sup> King,<sup>3</sup> and, most recently, by Rand and Reeves.<sup>4</sup> Since no such adequate description of this unusual condition can be found in the ophthalmologic literature; since, as a matter of fact, considerable confusion exists as to the actual nomenclature applied to the tumors under consideration, a summary of these papers would seem to add greatly to the worth of this report. The tumors in question have been described under the heading of "Pearly tumors," "Cholesteatoma vera," and "Epidermoids." This confusion is the result of the perpetuation of terms which entered the literature when the etiology and nature of the lesions were poorly understood. The situation is greatly clarified by sketching in historical perspective the development of our knowledge of the condition, and by bringing into focus controversial ideas as to etiology contemporary with the various stages in this development. In this sketch

we have drawn freely from the aforementioned papers.

These tumors are epithelial in origin. They are thought to originate from epithelial-cell rests which become pinched off from the epithelial body covering during development. Such rests, remaining quiescent in early life, for some reason become activated at maturity. These primary epidermoids should not be confused with secondary epidermoids such as might result from the migration of epithelial cells through a marginally perforated ear drum, as is the result of blockage of a sinus after migration of such cells, or even as the result of the traumatic implantation of such cells within the diploic spaces. Macroscopically and microscopically there is no distinction between the two. The location of the growth in an area in which there could be no possible contact with mature epithelium is the distinguishing feature. The epidermoid differs from the dermoid in that its wall contains only squamous or basal epithelium. Such a tumor, lacking the sweat and sebaceous glands of the true dermoid, is potentially unable to develop into the so-called oil cyst of the orbit. It should present in all or in part the following characteristics: Theoretically the wall of the tumor should be composed of three layers. There should be an outer, relatively acellular, connective-tissue layer supporting a thinner, second, epithelial layer. The connective-tissue layer should consist of scattered fusiform and stellate fibroblasts embedded in a mass of intercellular fibers with few blood vessels. The second layer internal to that just described should consist of stratified squamous epi-

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thelium, the cell layers varying in thickness. The cells in the outer layers should be flattened, parallel to the surfaces, and should have no nuclei. Those composing the inner layers should be more cuboidal in shape and perpendicular in direction. Keratohyaline granules should be present in the cytoplasm of these cells, and for the most part the nuclei should be well preserved. Intracellular bridges may be seen. The inner third layer should consist of cornified epithelium. From this layer inward the epithelial debris accumulates as the cells are cast off. The lining membrane may be calcified so that the tumor is surrounded by an eggshell-like wall.

The first report of a tumor of such characteristics is credited to Cruveilhier (1829). In this report the growth was described as a "Tumeur perlée." By means of this term an attempt was made to describe the nodular and highly refractile surface of the tumor. In his report, Cruveilhier noted that two similar tumors had been seen by LePrestre and Dumeril, in 1807. In 1938, Johannes Mueller reported two tumors which fall within this group. Mueller was most impressed by the cholesterol crystals found in these cases and applied the name *cholesteatoma*. One of Mueller's two cases was the first reported case of what we now term *extradural diploic epidermoid*. Virchow, in 1855, reported four additional cases falling within this group. He objected to the term *cholesteatoma*, pointing out that cholesterol crystals were not a constant finding. In common with Cruveilhier, he elected the term "*Perlgeschwülste*" as being most descriptive. In the meanwhile, Von Remak, in 1854, first suggested that these tumors arose from embryonic epithelial-cell rests. These investigations, according to King, afforded the basis for the term *epidermoid* later used by Bostroem (1897). Cushing<sup>5</sup> (1922) observed that these tumors, quite rare as a group,

occurred yet more infrequently when originating in the cranial diploe. The extreme rarity of the condition is further appreciated when it is realized that in Cushing's series of 2,500 verified intracranial tumors there were, according to Mahoney,<sup>6</sup> only 15 epidermoids—an incidence of 0.6 percent. The same author was able to find in the entire literature only 142 true epidermoids—of these only 23 were of the diploic type. Cushing reported one such case and collected from the literature six others. To the group he applied the term *epidermoid cholesteatoma*. More recently, Rand and Reeves have stated that: "From recent publications it is becoming increasingly evident that the terms 'dermoid' and 'epidermoid' are more frequently used in describing these neoplasms."

*Diagnosis.* Cushing, in 1922, stated that insofar as he knew the condition had never been diagnosed except at autopsy or operation. He also stated, however, that "They are capable of recognition roentgenologically, owing to the sharp bony defect and are capable also of complete surgical removal if approached by a flank rather than by direct attack in order that the epidermal membrane may be completely removed." Since the appearance of Cushing's paper, King, Olivecrona, and perhaps others, have on the basis of X-ray findings ventured preoperative diagnosis. The roentgenologic characteristics of the cranial defect produced by this condition are said to be positive and unmistakable. The outstanding and differentiating feature is the sharply defined, dense, white, scalloped margin found in no other condition. Any other eroding lesion, regardless of its nature, produces a defect the margins of which are poorly defined, hazy, or perhaps even fuzzy and soft. King further states that in a typical defect produced by the diploic type in

which the inner table is more involved than the outer, when viewed so that the greatest diameter of the defect is shown, the latter has a scalloped dense clear-cut margin, showing that this margin is more compact than the remainder of the skull. One or more bony hiatuses may be observed in the skull. These represent areas in which the outer table has been completely destroyed. If the roentgenogram is taken so that one views the defect "on edge," as though looking at a saucer edge-wise, a dense line two or more millimeters wide is seen. This is due to the superimposition of the dense margins of the defect which brings the compact bony margins in alignment. The outer table may then be so thin as to be invisible in an underexposed film.

Other than the roentgenologic characteristics just described, there is nothing characteristic in the clinical findings. In 12 of the 14 cases of congenital epithelial tumor (dermoid or epidermoid) reported by Love and Kernohan<sup>7</sup> headache was the presenting symptom. In general, headache, mental disturbance, convulsions, palpable masses or swellings, disturbances of gait, vertigo, and disturbances of vision have been the presenting symptoms. Exophthalmos has been noted in only a few cases. One should be alert to the possibility of such a lesion if a patient presents himself with a painless swelling associated with obvious bone erosion which has increased very gradually in size without other signs and symptoms.

In consideration of the rarity of the tumor, especially when so situated as to produce exophthalmus we feel justified in reporting the following case.

#### CASE REPORT

E. S., a 24-year-old white woman, a textile worker, was admitted to Duke Hospital for determination of the cause of a gradually increasing loss of vision in

the left eye of four years' duration. The past history was irrelevant insofar as any connection with the presenting signs and symptoms was concerned. At no time had there been evidence of inflammation in this area, nor any pain. There had been no suggestion of symptoms indicating increase in intracranial pressure.

*Examination.* The patient was a well-developed, obese, white woman, alert, coöperative, and in no distress. Except



Fig. 1 (Thornhill and Anderson). Exophthalmos due to cholesteatoma of the orbit.

for the exophthalmos of the left eye, there was a normal configuration of the head and face (fig. 1).

The right eye and adnexa were normal. The marked exophthalmos of the left eye was especially impressive—measured with the Hertel exophthalmometer this amounted to 5 mm. (O.D. 15 mm.; O.S. 20 mm.). The veins of the lid were not dilated. No pulsations were felt. There was no bruit; nor was there pain on pressure or movement, or any limitation of movement. A soft, nontender mass, rubberlike in consistence was palpable under the supraorbital ridge. The ridge had lost its smooth, rounded contour and was sharply defined. On downward gaze there was a definite momentary distortion of the sclera in the upper portion which would persist for an instant and then round out. The pupils were regular, equal, and reacted to light and accommodation. Ophthalmoscopic examination of the right eye was essen-

tially normal. The optic disc of the left eye appeared paler than normal with blurred edges, probably due to the high astigmatism. The vessels were not unduly full nor tortuous. There were tension lines in the retina in the supratemporal

Accessory clinical findings: Hemoglobin 90 percent, white blood cells 11,360 with a normal differential, Wassermann test negative, basal metabolism rate  $-4$ , blood sugar 90 mg. per 100 c.c., serum cholesterol 208 mg. per 100 c.c.

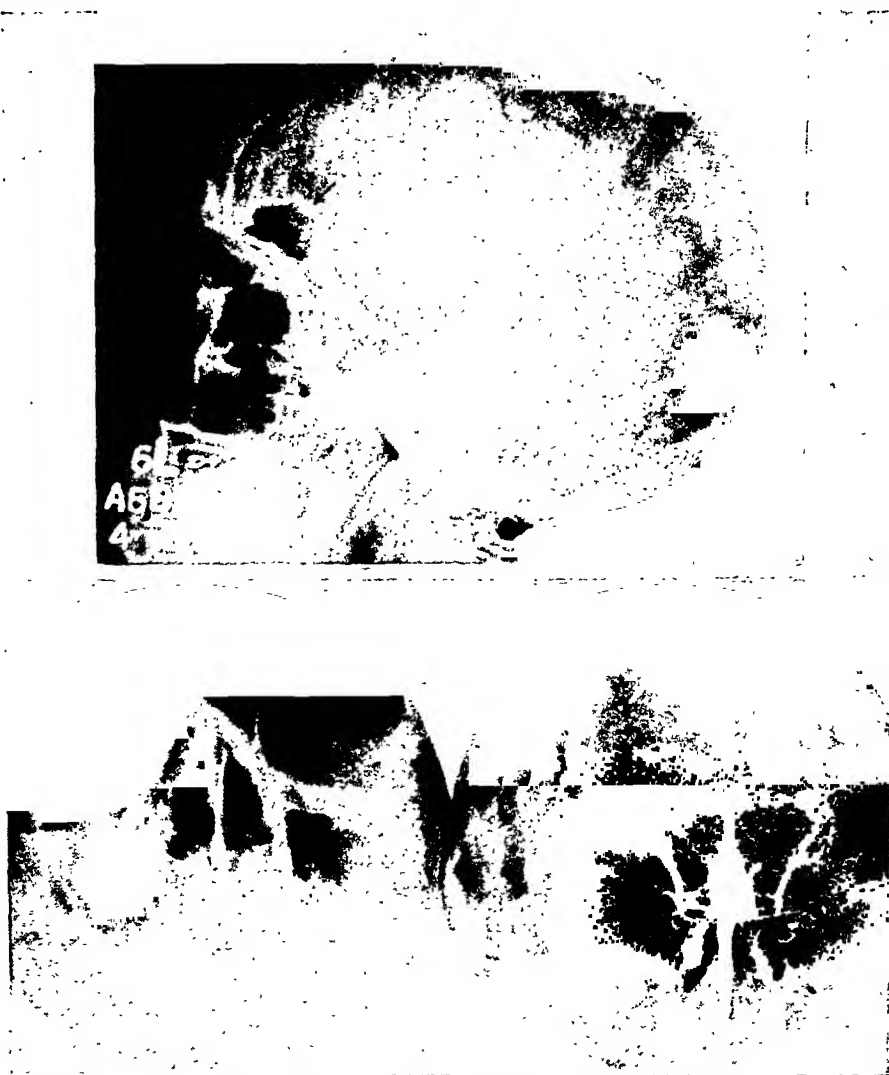


Fig. 2 (Thornhill and Anderson). X-ray studies in a case of cholesteatoma of the orbit.

region, radiating laterally from a center adjacent to the papilla. The peripheral fields showed no constriction. The right eye was emmetropic. The left eye required a  $-5.50\text{D. cyl. ax. } 180^\circ$  for 20/20 acuity. No interesting nor pertinent information was obtained in the general physical examination of the body systems.

X-ray (fig. 2) report was as follows: "Films of the orbit and optic foramina showed no erosion around the foramina. The upper wall of the left orbit has been destroyed, and an area of excavation extends upward measuring more than 2 cm. in diameter. There is no new bone formation, and the process must be differentiated between Schüller-Christian's

disease and a cholesteatoma."

**Impression:** Retro-orbital tumor (unclassified).

**Operation.** Under gas-oxygen-ether anesthesia the left orbit was explored through a supraorbital incision. As the periosteum was elevated an oval defect of bone was uncovered just above the supraorbital ridge and at the junction of its outer and middle thirds. The defect was approximately 1.5 by 2 cm. in size.

In the more central portion the lamination became less conspicuous and finally indistinguishable from the central caseous core. These putty- and cheeselike contents were excavated with a spoon, after which the entire capsule was cleared away by meticulous piecemeal dissection. The inner table of the skull was found to have been completely eroded beneath this mass. The dura was intact but considerably depressed. The anterior superior



Fig. 3 (Thornhill and Anderson). The appearance of the mass exposed at operation. -

Through it protruded a nonpulsating yellowish-white avascular mass. As the periosteum was further deflected three smaller perforations contiguous to that first exposed were uncovered. These were 2, 2, and 3 mm. in diameter (fig. 3). The bone lying between these dehiscences was of tissue-paper thickness. By removing these three intervening bridges the four defects were converted into one large opening through which an oval mass approximately 3 cm. presented. The surrounding capsule was quite friable and, in the manipulation necessary for removal of the tumor it ruptured. The contents thus exposed consisted of an outer layer of shell, 1.5 mm. in width, of white puttylike material laminated in concentric layers parallel to the friable capsule.

wall of the orbit was also eroded and the contents depressed inferiorly. Careful search was made for any connection with any of the accessory nasal sinuses, but none could be demonstrated. The left frontal sinus was quite small and definitely medial to the area under discussion (fig. 2).

Immediately following the operation the eye receded to its normal position within the orbit.

The postoperative course was uneventful. Following operation the exophthalmometer readings were O.D. 15, O.S. 17. Vision was O.S. 20/300, with a -5.00D. cyl. ax. 180° it equalled 20/20.

One month later the exophthalmometer readings were 15 O.U. Vision was O.D. 20/20, O.S. 20/20 with +3.00 D.sph. =

-2.50D. cyl. ax. 180°. The fundus picture had not changed.

The *pathologic report* was as follows: "The pathologic specimen is material described as having been removed through the left orbit from the frontal region, and is said to have had the appearance at operation of a cholesteatoma. The material received includes approximately 14 gm. of tissue, which includes both irregular fragments of opaque, hyaline-like fibrous tissue and large irregular pieces of pinkish-gray, cheesy material. The irregular fragments break very easily on manipulation, compatible with the clinical description of the irregular hyaline strands which represent the capsular tissue; whereas the softer, grayish, cheesy material undoubtedly represents the evacuated contents. Grossly this tissue is compatible with the clinical diagnosis of cholesteatoma.

"The microscopic examination reveals for the most part two types of tissue. The first is represented by small irregular fragments of acellular, pale, eosin-staining, hyalinelike material. Nowhere in such fragments do we see anything which resembles connective-tissue cells nor anything which may be identified as epithelium. In some such fragments there is lamination with separation of adjacent keratinlike material. This tissue apparently corresponds to what was described at operation as the capsule. In addition there are also some fragments of tissue which may represent a part of this capsular tissue which has the appearance of elastic-tissue fibrils. There are also fragments of acellular, amorphous material in which no structure is evident. The lat-

ter tissue corresponds to the material so frequently seen within epithelium-lined cysts. However, nothing can be said in regard to its character inasmuch as material is not available for fat stains. There is no histologic evidence of cholesterol."

The microscopic picture of the tissue examined seems compatible with the clinical diagnosis of cholesteatoma. However, it must be pointed out that we are unable to identify the nature of the capsule and there is nothing to suggest either endothelium or epithelium.

#### SUMMARY AND CONCLUSIONS

Extradural diploic epidermoids producing unilateral exophthalmos are not usually considered among the possibilities in the differential diagnosis of the causes of this condition. None the less, the condition may exist in areas adjacent to the orbit and may be the cause of exophthalmos. The possibility that unilateral exophthalmos is due to such a lesion can probably be proved or eliminated by X-ray studies once the possibility is recognized by the typical scalloping of the edges with marginal increase in bone density demonstrated through proper angulation and exposure.

Complete removal and a cure was obtained in this case through the supra-orbital approach. It is doubtful whether this particular type of tumor ever occurs so far back in the orbit (the tumor arises from diploic spaces which are not present in the walls of the orbit) as to justify the transfrontal approach recommended by neurosurgeons.

Box 3802.

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## CONGENITAL CATARACT AND OTHER ANOMALIES FOLLOWING GERMAN MEASLES IN THE MOTHER

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In Australia in the summer of 1940 there was a severe epidemic of German measles. Overcrowding due to the influx of military recruits might have contributed to the rapid spread of the disease and its virulent nature. In the first part of 1941 an unusual number of cases of congenital cataract appeared in Sydney. Dr. N. McAlister Gregg published, in the *Transactions of the Ophthalmological Society of Australia*, a report on "Congenital cataract following German measles in the mother" and subsequently a nationwide investigation was conducted by the National Health and Medical Research Council. The results of their findings are here reviewed and the author cites three similar cases seen in New York within the past few months.

### GREGG'S FINDINGS

Gregg's report is based on 13 cases of his own, 7 of his colleagues' seen by him, with a total of 78 cases in all, including those reported by his colleagues to him for reviewing. The findings were as follows:

*General.* Most babies were small, ill-nourished, and difficult to feed.

*Cataract.* All of the babies had cataract from birth; all were bilateral cases except 16. The opacities were seen to fill the entire pupillary area when the pupil was un-

dilated; but after dilatation two main types were observed. In the first, the contrast was marked between the larger, dense, pearly-white central area and the smaller, clearer, more peripheral zone. In the second, the density of the cataract was more uniform throughout. The process involved all but the outermost layers of the lens and was considered to have begun quite early in the life of the embryo.

*Vision.* The response to light was sluggish, but the babies appeared to follow readily any movement of the light stimulus.

*Nystagmus.* In young patients this was absent, but in older babies, or in patients whose treatment had been delayed, it was present. Movements were of a coarse, jerky, purposeless nature, rather than a true nystagmus. It was a searching movement, indicating an absence of development of fixation. It was present after treatment was delayed beyond the age of three months.

*Variations.* Three patients had corneal haze denser in the center than in the periphery. After two weeks the cornea cleared and the typical cataracts were seen. In one of these cases, the mother developed cataract during the pregnancy at the age of 27 years.

*Monocular cases.* There were 16, of which 10 presented microphthalmia.

*Heart.* Of Gregg's 13 cases all but one

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baby had a congenital heart condition. In the series of 78 cases, a congenital heart lesion was present in 44, while in many others the question was equivocal, evaded, or suspicious. Autopsy findings in three cases revealed a large patency of the ductus arteriosus, and the author understood that in autopsies performed elsewhere a similar condition was found.

*Deaths.* In the entire series 15 deaths were recorded. Several were from bronchopneumonia, and in three there was a sudden rise of temperature to 105° or even 106°F. followed by death within 24 hours.

*Intolerance to atropine.* In not a single instance has it been possible to continue the administration of atropine throughout treatment. Even after one or two instillations the patient exhibited considerable constitutional disturbance, with pyrexia, restlessness, irritability, and difficulty in feeding. In some cases the iris had an atrophic appearance. Full mydriasis could not usually be obtained.

*Etiology.* By a calculation from the date of the birth of the baby, it was estimated that the early period of pregnancy corresponded with the period of maximum intensity of the very widespread and severe epidemic in 1940 of the so-called German measles. Special attention, therefore, was paid to the history of the mothers during pregnancy, and in each new case it was noted that the mother had suffered from German measles early in her pregnancy and, most frequently, in the first or second month. In some cases, at the time of the disease she had not realized that she was pregnant.

*Incidence of German measles in series.* In all but 10 of the 78 cases a history of German measles during pregnancy was obtained. In 2 of the 10 the report of measles was negative. In one there was a history of kidney trouble. In two the history was not asked for. In the remaining five the report is "no history of mea-

sles" or "not known." The majority of cases occurred in 1940 or early 1941. In Gregg's own 13 cases, the history of only 1 was negative. In this case the mother stated that she was kept so busy looking after 10 children that she could not recollect any details of her own health beyond the fact that she was ill at about the sixth week of pregnancy when one of the other children died suddenly from whooping cough. Even though ill, she was unable to go to bed during the last month before the baby was born, one month prematurely. In the great majority of cases the infection occurred either in the first or second month of pregnancy. In a few cases it was in the third month.

*Nature of the epidemic in 1940.* It was severe and accompanied by complications, and, in the majority of cases in this report, the maternal infection occurred in July or August of this year. Occurring concurrently with this epidemic were epidemics of sore throat emanating supposedly from military camps and spreading to the civilian population. The author questions whether or not the sore throats were streptococcal in origin and the rash diagnosed as "German measles" was a toxic erythema accompanying the streptococcal infection. The description of this rash by the physicians during the epidemic was pleomorphic. Out of 35 cases in which sufficient records are available, the affected baby was the first child in 26 instances, and in three others it was the second child. This notably high incidence in the children of primiparae indicates that the epidemic affected younger people.

*Management.* Babies should be operated on immediately to permit sufficient light stimulus to reach the retina so that fixation may be developed. If the stimulus is insufficient or delayed, nystagmus will result. The only contraindication to early operation is the general state of the baby's health.

*Operation.* The anterior chamber is

particularly shallow, and in many cases the very dense central portion of the lens has proved resistant to the needle. Sometimes it has separated off as a firm disc. In others, the whole lens has tended to move away from the point of the needle. In other cases the dissection has been straightforward and easy. Absorption has been slower than that of the ordinary congenital cataract. No opportunity has so far been afforded to examine the fundi of any patient after absorption of the lens matter.

*Prognosis.* At the present state of our knowledge, we cannot state whether or not other ocular defects are present, or whether they will develop.

REPORT OF COMMITTEE OF NATIONAL HEALTH AND MEDICAL RESEARCH COUNCIL. Under the aegis of the National Health and Medical Research Council, a circular letter was sent by Drs. Swan, Tostevin, Moore, Mayo, and Black to all medical practitioners in Australia to obtain data about children born of mothers who had suffered from exanthemata during pregnancy. When possible, permission was requested to interview the mother and to examine the baby. In the metropolitan area, when a pregnant woman developed rubella or morbilli, it was asked that the investigators be notified so that an interview and examination could be carried out and the child subsequently born examined. If the patient lived in the country, it was requested that data be supplied after the birth of the baby.

*Results of the investigation.* The mothers were divided into the following groups: (a) those who suffered from rubella during pregnancy, 49 cases; (b) those who had no knowledge of any exanthemata during pregnancy, 4 cases; (c) those who contracted morbilli during pregnancy, 9 cases; and (d) those who suffered from mumps during pregnancy, 2 cases.

*Summary.* Of 61 infants examined in the course of this investigation, 36 were found to have congenital defects.

Of the 49 mothers who had rubella during pregnancy, 31 of the infants subsequently born exhibited congenital defects. The abnormalities included cataract, deaf-mutism, heart disease, microcephaly, and mental retardation. Eye defects were noted in 14 cases—13 infants had cataracts, of which 10 were bilateral and 3 were unilateral; 1 had buphthalmos. Seven had deaf-mutism; 17 had cardiac abnormalities; all had some degree of microcephaly. With two exceptions all of the 31 mothers with congenitally defective children had contracted rubella within the first three months of pregnancy. The investigators concluded that the disease of the mother was rubella and not a type of streptococcic throat, thought by Gregg to be a possible factor. They were unable, however, to explain why these new complications of what was supposedly rubella asserted themselves unless the virus had altered. The epidemic of German measles in 1940 in Australia was particularly severe, and it may be that this severity was caused by the war and conditions where large numbers of susceptible recruits were herded together in military camps. The disease spread rapidly and the causative agent may have reached a higher stage of virulence. Other investigators have shown that avian and other mammalian embryos show, in contrast to adult tissues, a particular susceptibility to infectious agents. The authors feel that it is logical to assume that the human embryo possesses the same susceptibility to infection that avian and other mammalian embryos do, and that the etiologic factor of German measles, after penetrating the chorionic barrier, is capable of producing severe lesions in the embryo, whereas the same infection in the adult tissues of the mother leads to only minor effects.

From this investigation it is claimed

that when a woman contracts rubella within the first two months of pregnancy, the chances of her giving birth to a congenitally defective child are about 100 percent, and if she contracts rubella in the third month, the chances are about 50 percent.

In a personal communication to the investigators, Gregg stated that all his patients were retarded in their mental growth if not mentally defective. For this and other reasons, Gregg thought that few if any of the children with both eyes affected were likely ever to develop into completely normal children. Other observations in the investigation included the occurrence of deaf-mutism, sometimes with heart disease, of heart disease without other apparent defects, of microcephaly, and of hypospadias.

The investigators concluded with the suggestion that the next step in dealing with this problem should be to isolate the causative agent of rubella with the object of preparing a protective vaccine against the disease. In the meantime, the effect of repeated doses of convalescent serum should be studied not only on mothers in the incubation period of the disease, but also as a prophylactic measure for any pregnant woman who has not previously suffered from rubella. At least this should be done to protect the mother during the first three months of pregnancy.

#### CASES RECENTLY OBSERVED BY THE AUTHOR

In the past three months the author has had three patients who belong to the group described in the Australian reports.

*Case 1.* A. S., a girl born at full term without instruments, and weighing 5 pounds and 10 ounces, was examined on the third day because the parents noted a white reflex through the pupil of the right eye. Examination showed a dense,

white cataract occupying the entire pupillary area and preventing any fundus reflex. The pupil was small (from 2 to 3 mm.), and reacted slightly to light. The anterior chamber was shallow. The cornea was clear and the iris appeared normal. The intraocular pressure to palpation was normal. The entire eye seemed somewhat smaller than the fellow eye, and this explained the fact that the right palpebral aperture was narrower than the left. On the fourth day the baby had an attack of cyanosis and was given oxygen. This cyanosis was thought to be due to a congenital heart lesion. There was a murmur over the entire precordium, and X-ray films showed an enlarged heart. No subsequent attacks of cyanosis have occurred. There has been no feeding problem. No microcephaly was present. When the baby was six weeks old, there was a severe conjunctivitis of the right eye causing redness, swelling of the lids, and a mucopurulent discharge. This cleared up in a few days but was followed by high temperature, and meningococci were identified in the blood stream and in four joints. The patient survived this and in one month had an infectious diarrhea which has now cleared up. The baby is now three months old and weighs 7 pounds and 11 ounces. The mother had German measles in the third week of pregnancy. (I am indebted to Dr. Rich Siegel, the child's pediatrician, for data on the general condition.)

*Case 2.* G. D., a girl, born 12 days early without instruments, and weighing 5 pounds and 15 ounces, had, since birth, a dense white cataract in each eye. No fundus reflex could be seen. The pupils were small and reacted slightly to light. The irides appeared normal. The anterior chambers were very shallow. The corneas were clear. Both globes may have been slightly smaller than normal. Intraocular pressure seemed normal to palpation.

There has been no feeding problem, and the baby has gained weight steadily. No microcephaly was noted. A congenital heart lesion was diagnosed (patent inter-ventricular septum). The baby is now three months old and weighs 9 pounds and 2 ounces. The mother had German measles when four weeks pregnant.

*Case 3.* T. C., a girl born one week early without instruments, and weighing 4 pounds and 4 ounces had, since birth, a dense, white cataract in each eye. No fundus reflex could be seen. The eyes followed a light stimulus and exhibited a searching or nystagmoid motion. The pupils were 3 mm. in size and reacted sluggishly to light. The irides appeared normal. The anterior chambers were perhaps slightly more shallow than usual. The corneas were small and clear. There was definite microphthalmia of both eyes. The intraocular pressure was normal to palpation. Feeding the baby has been quite a problem, and now, at the age of five months, the weight is 8 pounds and 2 ounces. Microcephaly is present. There is a congenital heart lesion thought to be a patent ductus arteriosus. Other anomalies are mild pyloric stenosis and slight umbilical hernia. The mother had German measles during the first month of pregnancy.

#### DISCUSSION

All three of the author's patients had congenital cataracts and congenital heart lesions. All mothers contracted German measles within the first month of pregnancy, which was during a rather severe epidemic of German measles in the East,

about one and a half years ago. In the examination, the pupils in these cases were not dilated because the anterior chambers were quite shallow. It was thought that any additional information that might be obtained from mydriasis would not warrant the chances of inducing a glaucoma. Operations will be performed on these patients but they have been deferred for a month or so until the general physical condition stabilizes itself and a better evaluation of the heart condition can be obtained before the general anesthesia is given.

Some imponderables of this subject are: 1. Is the infection of the mother German measles?

2. If it is German measles, then why have we not noted before the occurrence of congenital anomalies in the children so infected?

3. If it is German measles, are the congenital anomalies which are now appearing the result of a more virulent type, or of an altered type, which may have gained access to this country through an increased traffic with Australia?

4. Has the cause-and-effect relation between other infections of the mother in the first three months of pregnancy and congenital anomalies existed in the past, but not been recognized?

5. Can any prophylactic measures be taken to prevent pregnant women from contracting German measles during the first three months of pregnancy?

6. Should pregnant women who contract exanthemata in the first three months of pregnancy be aborted?

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# THE METABOLISM OF THE CORNEA\*

## STUDIES ON THE OXYGEN CONSUMPTION OF CORNEAS OF RIBOFLAVIN- AND VITAMIN-A-DEFICIENT RATS

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The function of certain vitamin substances as prosthetic groups in respiratory enzymes is now firmly established. An insufficiency of one or of a group of these substances leads to definite pathologic changes in a variety of tissues, including those of the eye. Morphologic changes in the cornea have been cited as specific and pathognomonic of vitamin-A and riboflavin deficiencies. However, the associated metabolic disturbances of this particular tissue have not been studied.

Because of the intimate association between cellular activity and the uptake of oxygen, it is customary to use the measurement of the latter as one index to the rate of normal or altered metabolism. This fact rests on a firm basis, especially in the case of riboflavin, which, in the form of the flavoproteins (d-amino-acid oxidase, xanthine oxidase, cytochromereductase, and others) has an oxidation-reduction potential falling between the pyridine nucleotides and the cytochromes. The function of vitamin A as a prosthetic group in tissues other than the retina has not been shown, but since it obviously has some influence on epithelial structures it will be considered in a similar manner.

Duke-Elder<sup>1</sup> states that the metabolism of the cornea is extremely sluggish. Gundersen,<sup>2</sup> on the other hand, quoting Bessey's work, claimed that excised corneas of rats showed an astonishingly rapid metabolic rate.

Working with the Warburg respirom-

eter, Bessey<sup>3</sup> found that the entire cornea utilizes approximately 4 cubic millimeters of oxygen per hour per milligram dry weight; that is, four sevenths as much as liver tissue, four sixths as much as muscle tissue, and four times as much as cartilage. Kohra,<sup>4</sup> measuring oxygen consumption of excised rats' corneas with the Warburg manometer, found a high metabolic rate for corneal epithelium. Although he had not demonstrated it experimentally, he nevertheless concluded that the endothelium also has a high metabolic activity. On the other hand, the parenchyma was found to have a low metabolic rate. Orzalesi,<sup>5</sup> repeating the same experiment, confirmed Kohra's findings.

In the present study, an attempt has been made to correlate the specific morphologic alterations in the cornea (resulting from vitamin deficiency) with changes in the associated respiratory rates. To this end the results are presented in two parts. Part I is a discussion of clinical observations of ocular changes in vitamin-A and riboflavin deficiencies. In part II we present data on the metabolism of the corneal tissues and indicate the possible significance of the findings in the light of associated anatomic changes.

### METHODS

#### THE EXPERIMENTAL ANIMAL

Approximately 200 albino rats from the Sprague-Dawley Institute strain were

\* This study, aided by a grant from the John and Mary R. Markle Foundation, was undertaken by Dr. O. S. Lee, Jr., in partial fulfillment of the requirements for a Master's degree in Ophthalmology in the Graduate College, State University of Iowa.

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used as experimental animals. These rats were of both sexes and from 19 to 21 days of age when placed on the special diets.

Sixty rats were placed on a riboflavin-deficient diet and 25 rats on a vitamin-A-deficient diet. The remainder were fed on a control diet and allowed to grow to about 60 to 80 gm. in weight, when they were used for studies of normal corneas.

The rats were placed in individual cages with raised screen floors to prevent access to their own excreta. Tap water was given *ad libitum*.

### THE DIET

*A. Riboflavin-deficient diet.* Two types of diet were used. Thirty rats were given Diet no. 1 and another 30 Diet no. 2.

#### Diet no. 1

	percent
Casein (vitamin free, Labco)	15
*Salt mixture (Hubbell no. 351)	2
Cod-liver oil	5
Sucrose	15
Corn starch (extracted with alcohol)	47
Crisco	14
Cellophane (ground)	2

One vitamin-B-complex pill of the following composition was given to each rat daily:

	mg.
†Thiamine chloride	0.04
†Nicotinic acid	0.20
‡Ryzamin B	50.0
Sufficient alcohol-extracted cornstarch to make pill mass.	

For the control diet, 0.04 mg. of riboflavin was added to the pill.

#### Diet no. 2

(For one kilogram diet, enough to last 20 rats 7 days)

Casein (vitamin free, Labco)	200.0 gm.
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\* Hubbell, R. B., Mendel, L. B., and Wakeman, A. J. A new salt mixture for use in experimental diets. *Jour. Nutr.*, 1937, v. 14, pp. 273-285.

† Courtesy of Merck & Company.

‡ Burroughs Wellcome & Company.

Sucrose	362.0 gm.
Cerelose	362.0 gm.
Salt mixture (Hubbell no. 351)	25.0 gm.
Cellophane (ground)	30.0 gm.
Cod-liver oil	20.0 gm.
†Choline chloride	1.0 gm.
†Thiamine chloride (Betabion)	3.0 mg.
†Pyridoxine hydrochloride (Hexabion)	3.0 mg.
†Pantothenic acid, Ca salt	10.0 mg.
†Nicotinic acid	50.0 mg.
†Alpha-tocopherol (ethyl laurate)	6.0 mg.
Para-aminobenzoic acid	100.0 mg.
Inositol	100.0 mg.

A week's supply was made at one time and kept in the ice box. If kept for longer periods or at room temperature, there is a reduction in thiamine potency.

In the control diet, riboflavin\*\* (2 mg.) was added to the above mixture. Approximately five grams of food were eaten by each rat daily. The rats responded to the two riboflavin-deficient diets in practically the same manner. The second diet, however, was preferred because of its synthetic composition.

#### B. Vitamin-A-deficient diet\*\*

	percent
Casein (vitamin free, Labco)	20.0
Glucose	67.5
Salt mixture (Hubbell)	2.5
Cellophane (ground)	3.0
Spry (hydrogenated cotton-seed oil)	2.0
Brewers' yeast, Harris	5.0
Viosterol (Abbott's)	0.2 c.c. per kilogram

### PREPARATION OF CORNEAL TISSUES

*A. Removal of cornea from the eyeball.* The rats were killed by a blow to the occipital region. While the eyeball was held with a pair of fixation forceps, an initial incision was made by introducing a fine curved bistoury into the anterior chamber, after which the section of the cornea was completed with iris scissors. Care was taken to confine the cut to the limbus and not to include any scleral tissue. This precaution was necessary to

\*\* A modification of the vitamin-A-deficient diet for rats given in the U. S. Pharmacopeia, Eleventh Decennial Revised, p. 479.

prevent inclusion of iris and ciliary-body tissues with the cornea.

*B. Removal of corneal epithelium.* In experiments in which studies on the corneal epithelium and stroma were to be made separately, the epithelium was removed from the cornea of the intact eyeball by the following method: The globe was immobilized, and with a corneal spud the epithelium was scraped off carefully from the periphery to the center. With practice and reasonable care a complete sheet of epithelium was obtained by this method. This technique was checked by histologic studies and found to be satisfactory. After removal of the epithelium, the cornea was excised by the method previously described.

*C. Removal of endothelium.* An attempt was made to remove the endothelium for study but it was found impossible to obtain sufficient tissue for determination of oxygen uptake.

Both corneas from each rat were used in every experiment, and the tissues were placed at once in the respirometer cups which contain 0.5 c.c. modified Locke's solution.\* In studies on isolated epithelial tissue it was found necessary to exercise care to keep the sheet of epithelium from folding on itself and thus preventing adequate contact with the substrate.

#### MEASUREMENT OF OXYGEN CONSUMPTION

Oxygen uptake was determined by use of six Barcroft micro-differential manometers which had been calibrated in

\* The medium had the following composition (expressed as percent of the anhydrous salt)

NaCl	0.7
KCl	0.035
CaCl <sub>2</sub>	0.025
MgCl <sub>2</sub>	0.010
Na <sub>2</sub> SO <sub>4</sub>	0.025
glucose	0.075
Sorensen phosphate buffer (M/15) pH 7.4, 7.5 ml. per 100 ml.	

the usual manner. Redistilled kerosene colored with Sudan III was used in the manometers. The manometer vessels were of approximately 5 cubic centimeters' capacity.

In all experiments each of the six vessels contained corneas or epithelial tissues from two eyes and 0.5 c.c. of the modified Locke's solution. The six compensating vessels contained enough of the same solution to make the fluid volume uniform. Each central well or cup of the respirometer vessels contained a roll of filter paper and approximately 0.1 c.c. of 20-percent potassium-hydroxide solution to absorb carbon dioxide.

The respirometers were mounted on a shaking device, similar to that described by Dixon,<sup>6</sup> having a rate of 60 cycles per minute with an amplitude of 2.5 cm. in a water bath whose temperature was 39° C. Measurement of oxygen uptake was begun at the end of a 20-minute equilibration period. Readings were then taken at 10-minute intervals for one hour. Results are given in cubic millimeters of oxygen (N.T.P.) per cornea.

The rate of oxygen uptake was invariably independent of the rate of shaking. When the manometers were gassed with oxygen, the results were not different from ungasped-manometer values. Therefore, diffusion was shown to be adequate with the technique used.

All calculations were made on the basis of corneal units rather than gram-weight units. This was done because of the very slight weight of the cornea and because this weight was quite constant (an average of 0.9 mg. dry weight per cornea for rats weighing around 70 grams). It is also obvious that the small mass of epithelium did not lend itself to accurate weighing. Since this is a comparative study between the metabolic activity of normal cornea and corneas of vitamin-A- and riboflavin-deficient rats



rather than a comparison of oxygen consumption of cornea with other tissues, the present method of expression of results was considered to be adequate.

In order to permit a relatively accurate comparison between the oxygen uptake of normal and pathologic corneas on a unit-cornea basis, rats with normal corneas were taken for study when approximately 70 grams in weight. This weight was found to be similar to that of rats on vitamin-A- or riboflavin-deficient diets when they developed pathologic changes in the cornea.

## RESULTS

### PART I. CLINICAL OBSERVATIONS OF OCULAR CHANGES

#### RIBOFLAVIN-DEFICIENT RATS

Ocular signs of deficiency were first observed after five to seven weeks. The palpebral fissures became narrowed and the eyeballs appeared sunken in the orbits. The lids were edematous and there was a loss of hair about the lid margins. These changes were followed soon by the appearance of a serosanguineous fluid in the conjunctival sac, which resulted in crusting of the lid margins and at times in complete sealing of the lids. The initial corneal change was not vascularization as observed by Bessey and Wolbach,<sup>3</sup> Johnson and Eckardt,<sup>7</sup> and others, but rather a fine, sandy roughening of the epithelial surface demonstrable with focal illumination. After staining with 1-percent fluorescein solution, observation with a loupe or corneal microscope revealed fine stippling of the corneal surface. This usually occurred after the seventh or eighth week, and was accompanied by engorgement of the limbic vascular plexus. After an additional 7 to 14 days, beginning vascularization of the cornea was observed. The appearance of vascular loops and the manner of their extension into the corneal stroma compared with the excellent

and detailed description given by Bessey and Wolbach.<sup>3</sup> Gross corneal ulcers were noted in approximately 10 percent of the rats with vascularization of the cornea; the ulcers were superficial, perforation did not occur, and there was no massive sloughing of corneal tissue. Most of the animals were sacrificed for respiratory studies after corneal vascularization. In the few that were kept for further observation, the only additional corneal changes were an increased scarring of the tissue and some regression of the corneal vascularization. These animals usually did not live longer than two weeks after vascularization was first noticed.

#### VITAMIN-A-DEFICIENT RATS

The earliest manifestations were slight photophobia, lacrimation, and reddening of the conjunctiva which usually began during the third week of experiment. Shortly thereafter, the normally prominent protruding eyes appeared to recede into the orbit, with exaggeration of the aforementioned signs. A serosanguineous secretion developed. No changes were observed in the cornea until the fourth to sixth week, when a haziness was noticed, particularly about the periphery. The surface became dry, lusterless, and oily, and normal transparency was lost. The epithelial surface, however, remained intact, and no staining occurred with fluorescein. The degree and extent of the xerotic condition increased daily, and if the animal survived, keratomalacia usually developed within a week after the initial appearance of definite xerotic changes. With the appearance of keratomalacia, progression was extremely rapid, and in 24 to 48 hours, the cornea sloughed away in part or *in toto* and perforation followed. Examination of the corneas during the stages of xerosis failed to reveal the presence of vascularization. However, after the onset of kera-

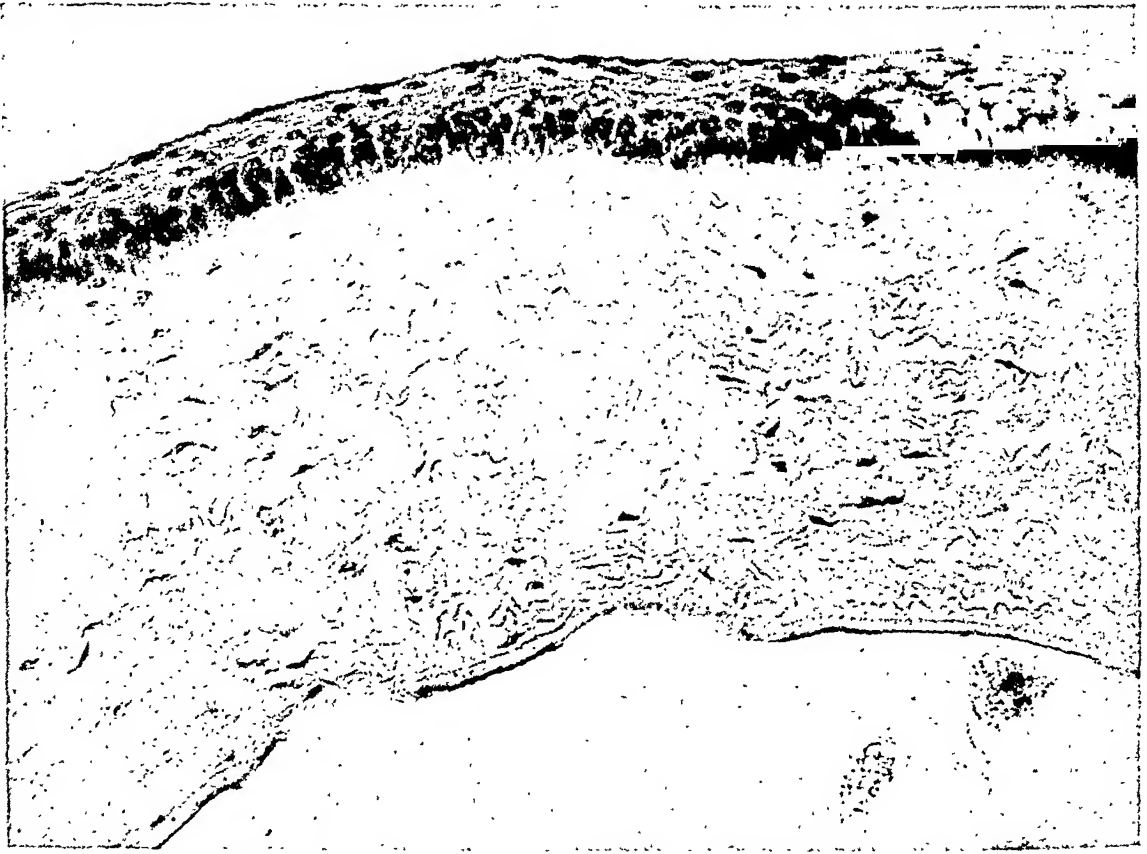


Fig. 1 (Lee and Hart). Normal rat cornea ( $\times 350$ ).

tomalacia, vascularization was seen. A conspicuous feature of the pathologic changes was the remarkable vitality of the corneal epithelium, for it remained intact throughout the stages of xerosis. Even when necrosis of the stroma was taking place in beginning keratomalacia, the anterior epithelium was often preserved. This observation has been previously reported by Yudkin and Lambert.<sup>8</sup>

## PART II. METABOLISM OF THE CORNEAL TISSUES

### NORMAL CORNEA

The assumption sometimes made that the metabolism of the corneal epithelium is slow and contributes little to the metabolism of the intact cornea is not supported by the observations made in these studies, nor is it in accord with the observations of the rapid regeneration of corneal epithelium following injury. The results of

the experiments here presented reveal that the oxygen uptake of the epithelium is rapid, for comparative studies show that the normal epithelium takes up the major portion of oxygen consumed by the excised intact normal cornea, whereas the stroma is relatively inactive (tables 1 and 2). The actual ratio of oxygen consumption between the stroma and epithelium is considerably greater than is shown in table 2, for these determinations were made on the basis of corneal units rather than on gram equivalents.

A comparison of table 1 with table 2 shows that the total oxygen consumption of the separated epithelium and stroma does not approximate that of the intact cornea. This discrepancy is to be expected, since there is some damage to the epithelial cells during the process of denudation. The technique used was at best relatively crude but still was superior to

other methods that were tried.

Since the endothelium consists of a single layer of cells on the posterior surface of the cornea it was found impossible to demonstrate its oxygen uptake with the present technique and instruments. Therefore, conclusions concerning the metabolic activity of the endothelium cannot be made at this time.

#### CORNEA OF RIBOFLAVIN-DEFICIENT RATS

In respiratory studies on vascularized corneas from riboflavin-deficient rats, it was found that the oxygen uptake of such corneas when intact was nearly the same as that of normal controls (table 3). Separate studies on the epithelium, however, showed its oxygen consumption to be markedly depressed, whereas the oxygen consumption of the vascularized stroma was much higher than that of normal corneal stroma (table 4). Further experiments revealed that if corneas were taken when epithelial damage only could be demonstrated and no pathologic change in the stroma was yet evident, the oxygen uptake of the epithelium continued to be low whereas the oxygen uptake by the stroma approximated that of the normal

TABLE 1  
OXYGEN CONSUMPTION OF THE INTACT  
NORMAL CORNEA

Number of Experiment	Weight of Rat grams	Oxygen Consumption*	
		30 min.	60 min.
1	80	0.96	2.01
2	100	0.85	1.76
3	70	1.31	2.26
4	72	1.41	2.28
5	60	1.17	2.32
6	100	1.38	2.50
7	82	1.09	2.13
8	125	0.60	1.64
9	87	1.04	2.20
10	70	1.09	2.30
11	70	0.77	1.59
12	142	1.36	2.21
13	50	1.10	2.37
14	50	1.18	2.33
15	50	1.62	2.59
16	56	1.74	2.06
17	90	1.37	2.60
18	90	1.60	3.20
Average		1.20	2.24

\* Figures represent cu. mm. oxygen (N.P.T.) consumed per cornea.

controls (table 5).

Since histologic studies of corneas of riboflavin-deficient rats demonstrated that the first change to take place in the eyeball is swelling and necrosis of the corneal epithelium (fig. 2), it would be logical to infer that the decrease in oxygen

TABLE 2  
OXYGEN CONSUMPTION OF EPITHELIUM AND STROMA OF NORMAL CORNEA\*

Number of Experiment	Weight of Rat grams	Epithelium		Stroma	
		30 min.	60 min.	30 min.	60 min.
1	100	0.38	0.97	0.27	0.36
2	100	0.28	0.61	0.18	0.34
3	80	0.63	1.21	0.41	0.68
4	80	0.42	1.71	0.20	0.30
5	70	0.78	1.56	0.05	0.10
6	72	0.62	1.22	0.41	0.60
7	100	0.61	1.20	0.46	0.56
8	102	0.59	1.18	0.40	0.67
9	140	0.60	1.13	0.32	0.47
10	68	0.55	1.10	0.35	0.52
11	92	0.49	1.03	0.03	0.05
12	70	0.49	1.00	0.23	0.73
Average		0.54	1.16	0.28	0.44

\* The corneal stroma also includes the endothelium which may be only slightly or almost completely stripped away.

TABLE 3  
OXYGEN CONSUMPTION OF THE CORNEA IN  
RIBOFLAVIN DEFICIENCY.  
INTACT CORNEA WITH VASCULARIZATION

Number of Experiment	Weight of Rat grams	Oxygen Consumption	
		30 min.	60 min.
1	63	1.52	2.93
2	66	1.54	2.89
3	54	1.47	2.64
4	49	0.79	1.56
5	63	1.03	1.80
6	64	0.62	1.51
7	60	0.74	1.41
8	54	1.12	1.91
9	53	0.82	1.65
10	70	0.60	1.21
Average		1.02	1.95

consumption of the epithelium was the result of the cellular destruction. The changes that follow damage to the epithelium consist of newly formed blood vessels which invade the stroma and are accompanied by cellular infiltrations (fig.

3). The presence of these cellular elements, which are absent in the normal avascular cornea, probably accounts for the increase in oxygen consumption observed in riboflavin-deficient corneas.

#### CORNEA OF VITAMIN-A-DEFICIENT RATS

In the experiments on xerotic corneas, the oxygen uptake of the entire corneas was the same or even higher than that of the normal controls (table 6). The oxygen utilization of the epithelium alone showed it to be in many cases higher than that of the normal corneal epithelium. The stroma, however, was found to be comparable to that of normal stroma in its relatively low metabolic activity (table 7). These findings are in accord with the results of Orzalesi,<sup>5</sup> who found the respiratory rate and glycolytic activity of vitamin-A-deficient corneas of rats to be more active than those of normal controls.



Fig. 2 (Lee and Hart). Cornea of riboflavin-deficient rat with early changes in the epithelium ( $\times 400$ ).

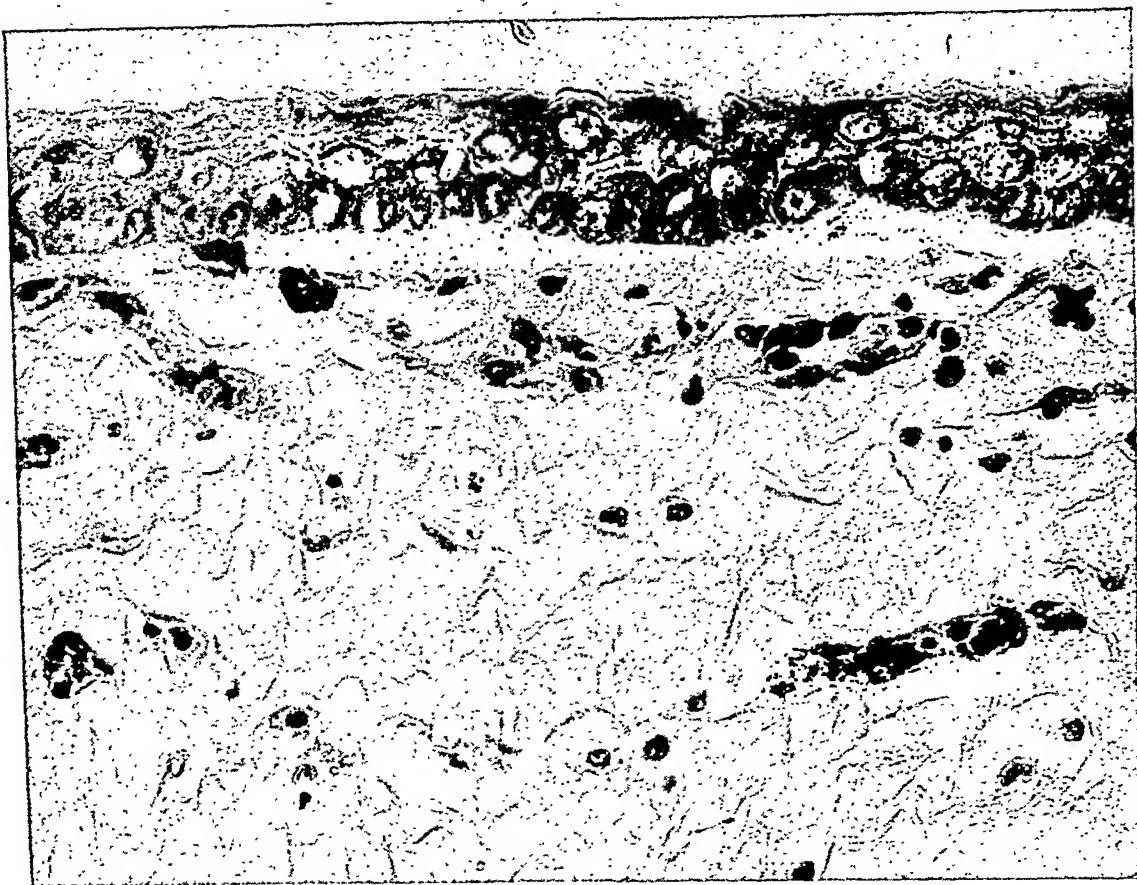


Fig. 3 (Lee and Hart). Cornea of riboflavin-deficient rat with more advanced changes in the epithelium and vascularization with infiltration in the stroma ( $\times 450$ ).

He attributed this to the marked necrotic changes in the tissue which might free certain substances capable of accelerating metabolism.

The metaplasia and hyperlasia of the corneal epithelium represent the first manifest pathologic change in the eyeball of rats on a vitamin-A-deficient diet (fig. 4). Most of the corneas used in the pres-

ent experiments were taken when the pathologic change was confined to the corneal epithelium and no changes were found macroscopically or microscopically in the deeper tissues. Therefore, the retention of approximately normal oxygen consumption of such corneas may be due to the absence of any damage to the vitality of the cells themselves, while even

TABLE 4  
OXYGEN CONSUMPTION OF THE CORNEA IN RIBOFLAVIN DEFICIENCY.  
EPITHELIUM AND VASCULARIZED STROMA

Number of Experiment	Weight of Rat grams	Epithelium		Stroma	
		30 min.	60 min.	30 min.	60 min.
1	46	0.21	0.71	0.60	1.35
2	48	0.23	0.53	0.85	1.70
3	70	0.12	0.29	0.72	1.41
4	56	0.17	0.30	1.00	1.79
Average		0.18	0.45	0.79	1.56

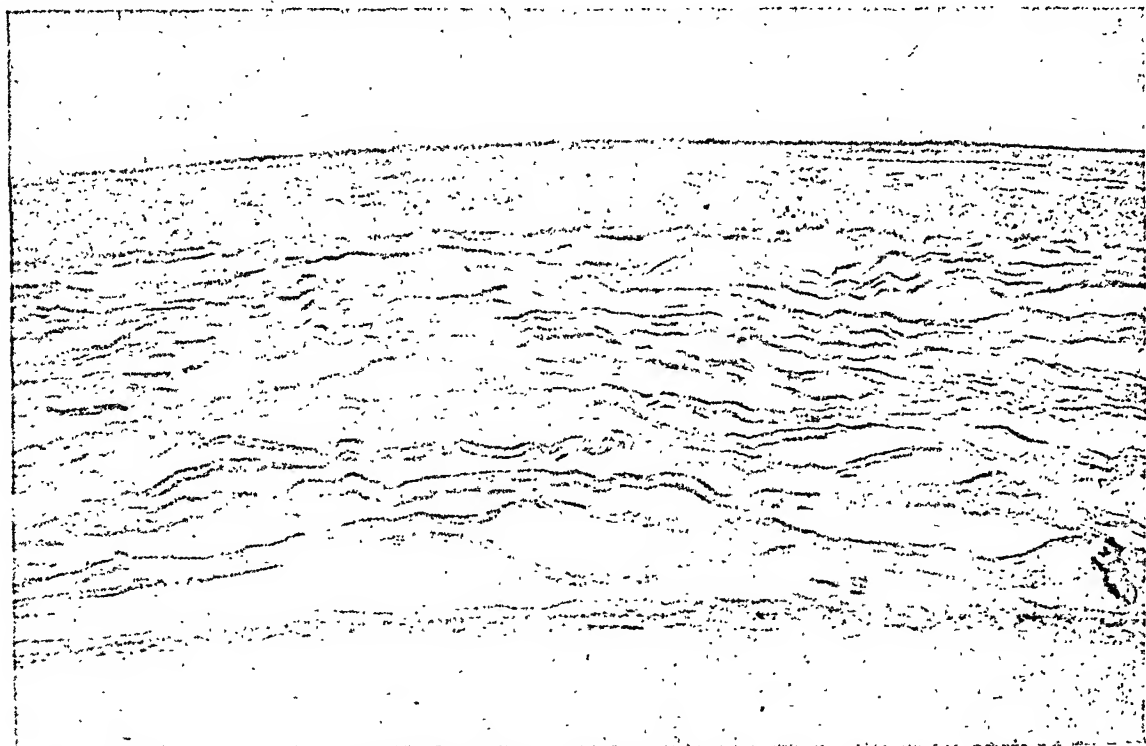


Fig. 4 (Lee and Hart). Cornea of vitamin-A-deficient rat with early changes in the epithelium ( $\times 400$ ).

higher oxygen uptake could be ascribed to the cellular hyperplasia that has taken place in the epithelium. When more complete keratinization of the epithelium had occurred, vascularization of the stroma was observed. New blood-vessel formation usually is associated with necrosis and cellular infiltration of the stroma (fig. 5). These changes representing an ad-

vanced stage of the vitamin-A deficiency rapidly result in complete sloughing of the tissues and rupture of the cornea.

Figure 6 is a composite chart which gives a graphic view of all the data on oxygen consumption.

#### COMMENT

There has been no clear-cut demon-

TABLE 5  
OXYGEN CONSUMPTION OF THE CORNEA IN RIBOFLAVIN DEFICIENCY.  
EPITHELIUM AND NONVASCULARIZED STROMA\*

Number of Experiment	Weight of Rat grams	Epithelium		Stroma	
		30 min.	60 min.	30 min.	60 min.
1	50	0.15	0.31	0.28	0.56
2	70	0.14	0.28	0.11	0.19
3	50	0.22	0.54	0.04	0.12
4	52	0.08	0.17	0.40	0.52
5	60	0.10	0.41	0.28	0.56
Average		0.14	0.34	0.22	0.39

\* In experiments in which nonvascularized corneas were used, only those eyes which showed a diffuse haziness of the epithelial surfaces were taken. These corneal changes represented the earliest manifestations observed in riboflavin deficiency of rats and consisted of edema and necrosis of the epithelial cells, as illustrated in figure 2.

stration of the sequence of changes occurring in the eye in the vitamin deficiencies in question. Indeed most authors have not seen the need for making such observations. Nevertheless, this consideration may have the utmost importance in the attempt to unravel the physiologic changes involved in vascularization. With regard to riboflavin deficiency in the rat, Bessey and Wolbach<sup>3</sup> state that capillaries grow into the cornea from the limbus after the fourth week. Quoting from their paper, "This happens before any change in the cornea visible in the gross has taken place. The transparency is undiminished. While these vessels may be seen by slitlamp illumination, no turbidity of the cornea or change in the corneal epithelium is revealed by this method or by histological study." And from the same paper with regard to vitamin-A deficiency: "We are disposed to disregard the inflammatory explanation of vascularization. Always,

TABLE 6\*  
OXYGEN CONSUMPTION OF THE CORNEA IN  
VITAMIN-A DEFICIENCY.  
INTACT CORNEA

Number of Experiment	Weight of Rat grams	Oxygen Consumption	
		30 min.	60 min.
1	100	0.70	1.63
2	70	1.30	2.46
3	68	1.07	2.05
4	75	1.26	2.30
5	56	1.20	2.06
6	55	0.90	1.79
Average		1.07	2.21

\* The corneas used in these experiments were in various stages of xerosis. The xerotic process, however, was in all cases grossly visible to the unaided eye. A few of them showed beginning keratomalacic change in the stroma, as evidenced by an early necrosis of the stromal fibers on histologic study. However, no corneas with softening of the cornea visible macroscopically nor those in which perforation had taken place were used.

however, the presence of capillaries in the cornea was accompanied by a characteristic change in the corneal epithelium, indicative of the shift to a keratinizing

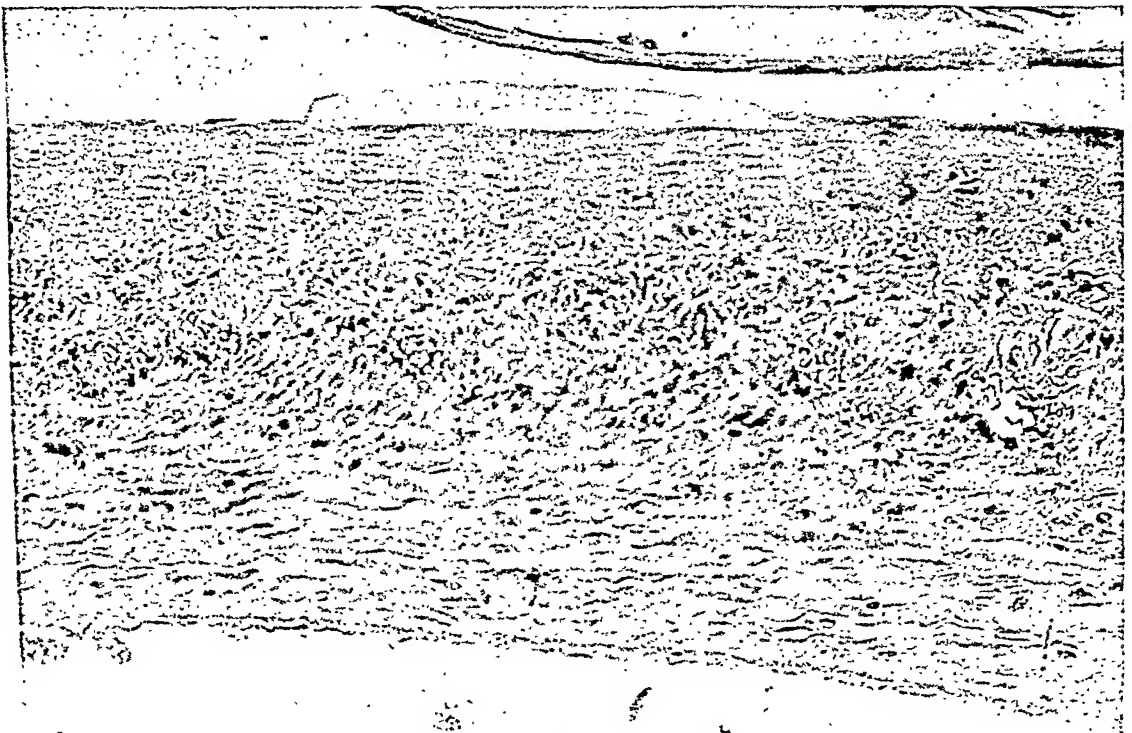


Fig. 5 (Lee and Hart). Cornea of vitamin-A-deficient rat with more advanced changes in the epithelium and vascularization with infiltration in the stroma ( $\times 400$ ).



hyperplasia. The speculation is warranted that an important factor in causation may be a change in permeability of the epithelium in its effect upon respiration of the cornea as a whole."

These authors postulate a functional change rather than a change in the morphology of the epithelium to account for the ingrowth of vessels. Wolbach and Howe<sup>9</sup> had previously observed that in

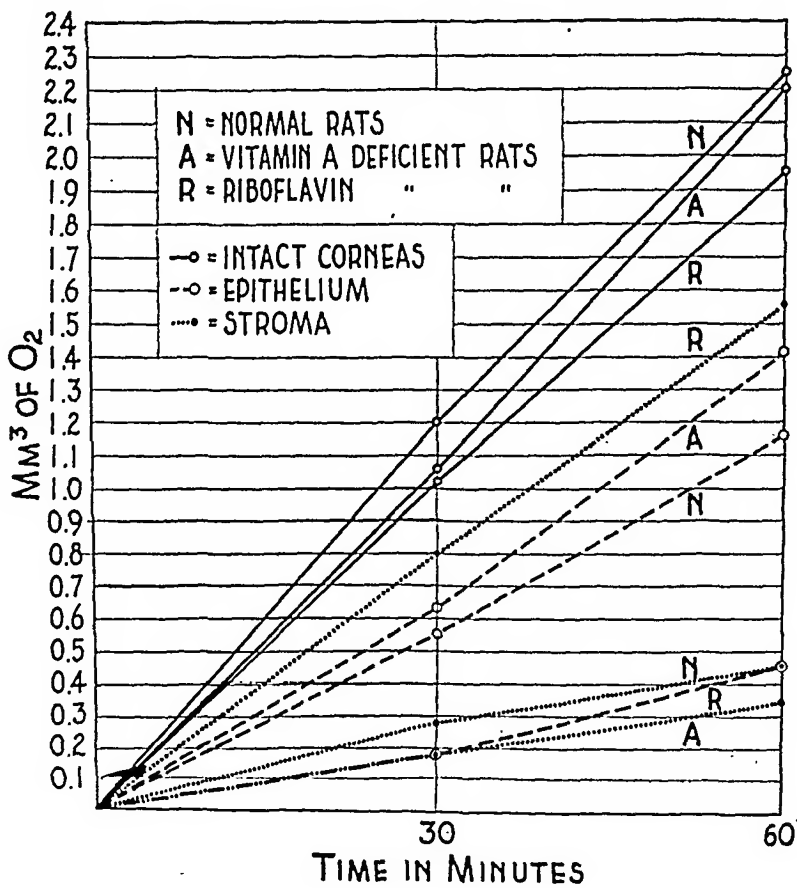


Fig. 6 (Lee and Hart). Composite chart from tables 1, 2, 3, 4, 6, 7, showing the average oxygen consumption of normal rat corneas and rat corneas of vitamin-A and riboflavin deficiencies.

TABLE 7\*  
OXYGEN CONSUMPTION OF THE CORNEA IN VITAMIN-A DEFICIENCY.  
CORNEAL EPITHELIUM AND STROMA

Number of Experiment	Weight of Rat grams	Epithelium		Stroma	
		30 min.	60 min.	30 min.	60 min.
1	85	0.35	0.80	0.17	0.26
2	65	0.86	2.01	0.21	0.39
3	60	0.84	1.95	0.16	0.30
4	70	0.60	1.50	0.14	0.31
5	60	0.40	0.90	0.20	0.32
6	50	0.56	1.05	0.17	0.40
7	75	0.72	1.50	0.20	0.35
Average		0.62	1.42	0.18	0.33

\* See footnote, table 6.

vitamin-A deficiency vascularization of the cornea followed keratinization of the epithelium and postulated that the response was due to greater physiologic demands from active and changed epithelium. In the later work, Bessey and Wolbach<sup>3</sup> reviewed the same material and, finding certain similarities to their observations in riboflavin deficiency, decided that vessel ingrowth occurred concurrently with the epithelial changes. This order of events apparently appeared to the authors to preclude an "inflammatory" explanation of vascularization. It would be difficult to criticize the inflammatory hypothesis since the mechanism of such a reaction is entirely unknown, nor is it altogether clear what is meant by a "change in permeability."

A variety of possibilities might be drawn upon in developing a logical explanation for vascularization of the cornea under these conditions. The suggestion offered by Bessey and Wolbach that vascularization is a response to asphyxia of the tunica propria has merit in that it suggests a new tack for further work, and indeed constituted the chief stimulus for the present endeavor.

At present we may safely assume some intimate relationship between the epithelium and the stroma, but the fundamental mechanisms are still obscure and no simple explanation can dispose of the problem. It is a significant fact that in our

experiments, vascularization of the corneal stroma in both riboflavin- and vitamin-A-deficient rats is preceded by a morphologic change in the epithelium.<sup>3</sup>

### SUMMARY

1. The normal epithelium of the cornea is shown to have a high oxygen uptake in contrast to a low uptake by the stroma. Because the endothelium consists of only a single layer of cells, it was impossible to measure its oxygen consumption by this method.

2. The oxygen uptake of the corneal epithelium of riboflavin-deficient rats was found to be lessened. This may be accounted for by the cellular necrosis present in the epithelial cells of such corneas. When vascularization was present, the oxygen uptake by the stroma was found to be elevated, whereas in the absence of vascularization the oxygen uptake remained low. It is reasonable to assume that the increased oxygen uptake by the stroma is the result of vascularization and cellular infiltration.

3. The metabolic activity of the xerotic cornea was found to be normal or higher than normal. The presence of metaplasia and hyperplasia instead of an actual cellular destruction of the corneal epithelium may be responsible for the approximately normal oxygen consumption of corneas of rats with vitamin-A deficiency.

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## THE USE OF TYROTHRIN, A BACTERIAL EXTRACT, IN THE TREATMENT OF MARGINAL ULCERS OF THE CORNEA\*

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In 1939, Dubos<sup>1</sup> reported the isolation, from bacterial culture, of a substance that destroyed gram-positive cocci. This antibacterial extract was tyrothricin; it was prepared from cultures of the *Bacillus brevis*, an aerobic sporulating saprophyte commonly found in sewage and soil.<sup>2, 3</sup> Tyrothricin is a stable mixture of gramicidin and tyrocidine, both of which can be crystallized, with some difficulty, from the mother substance.<sup>4</sup> The antiseptic effect of tyrothricin is principally due to its content of gramicidin. Because of its greater stability and relative ease of preparation, tyrothricin is the substance preferred for clinical use.<sup>5</sup>

Gramicidin is a polypeptide that has been shown to inhibit the growth of gram-positive cocci.<sup>5</sup> Although this bacteriostatic action varies in effectiveness against different strains of these microorganisms, it is, in general, highly effective in even minute dosage of the drug.<sup>6</sup> Meningococci and gonococci are also inhibited by gramicidin, though to a lesser degree, whereas other gram-negative microorganisms have proved invulnerable to this substance.<sup>5</sup> It has been further shown that the presence of gram-negative bacilli interferes with the bacteriostatic action of gramicidin, so that it is quite ineffective against mixed infections. The drug is also inactivated by cephalin.<sup>5</sup> Gramicidin has been shown

to be slightly hemolytic,<sup>7</sup> a property which can be inhibited by small amounts of glucose or mannitol.<sup>5</sup>

Tyrocidine, which comprises 80 percent of the tyrothricin mixture, is a protoplasmic poison equally effective *in vitro* against gram-positive and gram-negative organisms.<sup>3</sup> *In vivo*, however, its action is largely destroyed by serum; it therefore contributes little to the effectiveness of tyrothricin as an antiseptic. The hemolytic and leucocytolytic effects of tyrothricin in large dosage have been attributed to its content of tyrocidine.<sup>7</sup>

Tyrothricin is soluble in alcohol and acetone but not in water or body fluids. It is also very poorly diffusible. Because of these physical properties and the toxicity of its component tyrocidine, tyrothricin is not employed systemically.<sup>7, 8</sup> However, its poor absorbability and highly potent bacteriostatic action in small dosage renders it a safe and very effective antiseptic against gram-positive organisms by topical administration or the irrigation of infected body cavities.<sup>9</sup>

The conjunctival sac presents a surface prone to infection with gram-positive organisms, especially staphylococci, streptococci, and pneumococci. Moreover, it is easily treated by topical application without danger to the body by absorption of the medication into the general circulation in any appreciable quantity. It was therefore thought that in infections of the ex-

\*From the ophthalmological service of Dr. R. K. Lambert, The Mount Sinai Hospital.

ternal eye and associated structures a favorable opportunity is provided for the therapeutic trial of tyrothricin.

Because of the greater availability of the more widely used antiseptic agents, and their usual efficacy in the treatment of the common infective conjunctivides, no attempt was made at this time to treat such cases with tyrothricin. However, several patients with stubbornly resistant marginal ulcerations of the cornea were brought to the hospital and these afforded an opportunity for a therapeutic test of this drug.

Marginal ulcers of the cornea are not uncommon. The most frequent type is that associated with the more severe catarrhal conjunctivides. In these cases the keratitic complication is considered an extension of the septic process in the conjunctiva. Treatment of the conjunctivitis with any of the usual antiseptics, occasionally supplemented by cauterization of the corneal lesion, usually results in rapid healing of the ulcer.<sup>10</sup>

There is another group of marginal corneal ulcers, more common in old people, that occurs without apparent cause, and is not associated with conjunctival inflammation.<sup>11</sup> These arise as marginal, subepithelial infiltrates which coalesce and break down to form superficial erosions crescentic with the limbus. Local ciliary injection is usually present, but very little general conjunctival reaction occurs. Such superficial ulcers usually heal readily when antiseptic applications or cauterization and pressure dressings are employed. However, they not infrequently prove quite resistant to such measures, and persist with distressing symptoms of photophobia, lacrimation, and pain.

Four instances of superficial marginal ulcerations of the cornea, not associated with conjunctivitis, and resistant to the usual forms of therapy, were recently

treated with tyrothricin at this institution. An alcoholic solution of the latter was suspended in distilled water in a concentration of 0.2 mg. per cubic centimeter. An ointment was also compounded consisting of tyrothricin in a petrolatum-lanolin base, in the same 1:5,000 concentration. Such extreme dilution had previously proved effective against infection in other areas,<sup>9</sup> and it eliminated the possibility of absorption in any quantity sufficient to cause toxic reactions. Instillation of these preparations in the eyes of rabbits and normal volunteers proved their innocuousness; subsequent therapeutic applications in numerous cases have failed to reveal any local or systemic toxic reaction.

*Case 1.* A. S., a man, aged 67 years, presented himself in the Out-Patient Department with the complaint of having had pain in the right eye for several days. Examination disclosed a staining marginal ulcer of the cornea of the right eye, with local ciliary injection. There was no evidence of associated conjunctivitis. Cultures of material taken from the corneal ulcer were reported to show the presence of *Staphylococcus aureus* A and *Staphylococcus albus* B. The left eye appeared to be normal.

A 1-percent solution of silver nitrate was applied to the lower lid of the right eye; a drop of 20-percent argyrol was prescribed to be instilled three times daily, and bichloride of mercury 1:5,000 to be instilled in the right eye each night. After five days on this regime the corneal ulcer was found to have increased in size crescentically. It was then cauterized with tincture of iodine and instead of the previously prescribed medication 5-percent-sulfathiazole ointment was instilled three times daily. Five days later the ulcer was found to be larger, and the regional ciliary vessels were more engorged. A pressure

dressing was applied but after several days no evidence of healing was seen. Mercurochrome 1 percent was instilled into the eye three times daily for five days thereafter, with no satisfactory results. The actual cautery was applied to the ulcer, but there was no apparent reduction in the size of the lesion. For 10 days thereafter the patient was treated only with 5-percent sulfathiazole ointment instilled into the right eye three times daily. During this period the staining lesion persisted unchanged and the patient's pain, lacrimation, and photophobia were very distressing.

Since routine methods had failed, the patient was instructed to apply one drop of the tyrothricin suspension to the surface of his affected eye every three hours, and to discontinue all other medication. After three days of application it was found that the ulcer was much smaller, ciliary injection much less marked, and the patient was greatly improved symptomatically. On the ninth day after tyrothricin therapy had been instituted no further staining of the cornea was present and the patient was considered cured. The region of the erosion presented a translucent superficial scar with no ciliary injection.

*Case 2.* R. L., a housewife, aged 58 years, appeared in the clinic complaining of lacrimation and pain in both eyes for two days. Examination disclosed small marginal infiltrates just within the nasal limbus of the left eye and similar lesions temporally in the right. There was some local ciliary reaction but no general conjunctival injection. One-percent atropine was instilled in each eye and 5-percent sulfathiazole ointment was prescribed for application three times daily, to be followed by hot compresses. After five days of this regime the infiltrates in the cornea of the left eye had disappeared, but those

in the right persisted. One drop of 20-percent argyrol was then advised for the right eye, to be instilled every four hours. After two weeks, the infiltration had involved the entire limbal circumference and marked circumcorneal hyperemia was noted. In addition, just within the limbus inferiorly, two staining superficial ulcers were seen. Cultures of material taken from these erosions yielded *Staphylococcus albus* B. Bichloride-of-mercury ointment 1:5,000 was instilled and a pressure dressing applied repeatedly. One week later the ulcerations were larger. Cauterization of these lesions was performed with tincture of iodine, and pressure dressings were applied on two occasions during the following week, but induced no improvement. Three days later the ulcerations had coalesced across the lower corneal margin in crescentic fashion. Trichloroacetic-acid cauterization was done, 5-percent sulfathiazole ointment instilled, and pressure dressing applied again. Two days later no improvement was noted.

At this point, after six weeks of therapy with the aforementioned agents, tyrothricin was prescribed. One drop of the suspension was ordered applied to the affected eye every three hours and tyrothricin ointment placed in the conjunctival sac at night. Three days later a diminution in the marginal infiltration and the ciliary injection was noted. The staining lesions of the lower corneal margin were definitely smaller and symptomatic relief was marked. Improvement continued uninterruptedly, and after two weeks of tyrothricin administration no further ulcer remained, the submarginal infiltrates had disappeared, and circumcorneal injection was minimal. At the site of the ulcer there remained a depressed white scar with slight peripheral vascularization.

*Case 3.* L. C., a woman, aged 72 years,

had undergone several epilations for trichiasis subsequent to an old trachomatous process of both upper lids. She presented herself at the clinic complaining of unusual pain, lacrimation, and photophobia in the left eye. Examination disclosed a marginal crescentic staining ulceration with ciliary injection at that point but no evidence of conjunctivitis. No cilium that might be irritating the cornea could be found on the lids at this time. A drop of 1-percent atropine sulfate solution was administered, 5-percent sulfathiazole ointment instilled into the conjunctival sac, and a pressure dressing applied. Two days later the lesion was larger and the patient's symptoms worse. The patient was then given tyrothricin solution to be instilled in the dose of one drop every three hours and the tyrothricin ointment was ordered applied nightly. Symptomatic improvement was rapid, and three days later the area of the staining lesion was noticeably smaller. After eight days the patient was completely cured and only an epithelized scar remained at the site of the ulcer.

*Case 4.* A. K., 45 years of age, presented a history of recurrent marginal corneal ulcerations. These previously had responded in a few days to local antiseptic therapy. On this occasion a staining erosion of the lower corneal margin of the left eye, not associated with conjunctivitis, had resisted treatment with 20-percent argyrol, sulfathiazole ointment, and repeated pressure dressings for 10 days. Cultures of the ulcer were taken twice, but no growth occurred, possibly due to antiseptics previously used. One drop of the tyrothricin suspension was instilled into the conjunctival sac every three hours, and all other medication stopped. The ointment was not employed after one application because the patient thought it irritating. After three days of this regi-

men symptomatic improvement was notable; on the fifth day ciliary injection had disappeared, and no further staining of the lesion could be seen.

#### COMMENT

The etiology of these primary superficial ulcerations of the marginal cornea is unknown. Fuchs<sup>12</sup> in 1893 considered them as a complication of the gouty diathesis. Duke-Elder<sup>11</sup> associates some with rosacea, but believes that most cases originate in a remote septic focus with metastatic corneal involvement occurring through the marginal vascular plexus. Whatever the cause, it seems very probable that infection, either primary or secondary, may be a factor in the persistence of the lesion and one against which active treatment is indicated. Where the more easily available antiseptics prove futile, tyrothricin appears to be a very effective therapeutic agent in this condition.

Since tyrothricin is now commercially available, the range of its clinical applicability deserves investigation. Studies are now under way to determine its effectiveness in other diseases of the eye. Further trial will be necessary to confirm our favorable impression of this apparently safe and extremely effective new antibacterial agent.

#### SUMMARY

1. Tyrothricin\* of Dubos has proven an effective antiseptic agent against gram-positive organisms.
2. It may be readily and safely applied to the conjunctival sac in effective concentrations.
3. Four cases of resistant marginal ulcers of the cornea are described in which tyrothricin was employed with gratifying results.

\*Tyrothricin is marketed by Sharp and Dohme, Philadelphia, Pennsylvania.

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## EXOPHTHALMIC OPHTHALMOPLÉGIA\*

## REPORT OF A CASE WITH THYROTOXICOSIS OF UNUSUALLY LONG DURATION

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Although somewhat more than 100 cases of exophthalmic ophthalmoplegia have been reported,<sup>1</sup> the syndrome still remains a clinical rarity. The causes of the exophthalmos and of the ophthalmoplegia, and the relationship of these ocular dysfunctions to disturbances of thyroid metabolism, are still unclear. Autopsy reports of cases of exophthalmic ophthalmoplegia are very rare; and it is for the purpose of adding to the available data for eventual clarification of this interesting entity that the following case history with the findings of post-mortem examination is reported. The case is of further medical interest because of the unusually long duration of symptoms of thyrotoxicosis, and their variability.

## CASE HISTORY

A. E. S., an unmarried white man, 55 years of age, and a butcher by occupation, was admitted to the U. S. Marine Hospital on June 30, 1942, complaining chiefly of generalized weakness of four months' duration.

\* From the United States Marine Hospital.

*Family history* was irrelevant; there was no knowledge of thyroid dysfunction or organic disease of the nervous system occurring in any close relative.

The *past history* included uncomplicated mumps, measles, chicken-pox, and scarlet fever in childhood; lymphangitis of the right forearm in 1918, resulting from infection of a laceration of the right hand; pneumonia in 1928, with uneventful recovery; and a cholecystectomy in 1932, performed because of gastrointestinal disturbances and roentgenologic evidence of a nonfunctioning gallbladder. There was no history of syphilis, or encephalitis, or cerebral trauma.

*History of present illness.* The existence of detailed records of medical examinations of the patient (records of examinations for insurance, for determination of disability claims, and for war-pension purposes) facilitated the accurate formulation of the clinical course, and the following data were derived from these records and from the patient's story.

In 1913, the patient first became aware of a "goiter," which manifested itself only



as a slightly uncomfortable, diffuse swelling of the suprasternal portion of the neck until 1916, at which time nervousness associated with emotional instability developed. In 1918, the patient was drafted into the United States Army, but the development of exertional dyspnea and palpitation rendered him unfit for military service and he received a medical discharge after less than three months' service. The discharge diagnosis was hyperthyroidism. At that time (1918) *both* lobes of the thyroid were moderately enlarged, but exophthalmos was not present. The heart was not enlarged, a soft apical systolic murmur being the only cardiovascular abnormality noted.

Following his discharge from the Army, the patient continued to be disturbed somewhat by nervousness, episodes of palpitation, and a tremor of the hands, and in July, 1921, he noticed moderate weakness of both arms associated with a sense of numbness in the fingers, and weakness of grip. In August, 1921, physical examination revealed symmetrical enlargement of *both lobes* of the thyroid gland. The heart was just within normal limits in size; a precordial heave and a palpable thrill at the apex were present. There was a loud, blowing, systolic murmur at the apex which was not transmitted. One examiner also described a very indistinct short presystolic apical murmur which, however, was not heard by other examiners. The pulse rate was 90 beats per minute, and the response to exercise was normal. The blood pressure was 135/95. Ptosis of the left upper lid and a left divergent strabismus were present. The left eye was more prominent than the right. The diagnosis made was exophthalmic goiter.

The patient's vision seemed to become impaired somewhat, and intermittent diplopia, headache, and blurring of vision developed in September, 1921. Physical

examination in November, 1921, revealed exophthalmos, ptosis of the left upper lid, and a left divergent strabismus. The visual acuity was 20/20 in the right eye and 20/40 in the left eye. Examination of the fundus showed obliteration of the physiologic cups of the nerve heads, without definite papilledema, and engorgement of the retinal veins. The heart was definitely enlarged to clinical examination, but the blood pressure was normal (108/76), and there were no irregularities in rhythm and no murmurs. The muscles of the arms were soft and flabby. The patellar reflexes were exaggerated. Romberg's sign was not present, and the sensory status was normal. The face was rather expressionless and immobile. Wassermann tests on the blood and spinal fluid were reported as "doubtful positive" from a city laboratory, but as negative from a larger state health laboratory. The colloidal gold curve was 0000000000, and the cell content of the spinal fluid was normal. Urinalysis revealed no abnormalities. The basal metabolic rate was then plus 24 percent. The examiners at that time suggested that the patient's difficulties might be due to a basilar meningitis or a brain tumor.

Three months later (in February, 1922) because of persistence of weakness of grip, clumsiness of hands, and the development of some difficulty in walking which he attributed to weakness, the patient again sought medical advice. The positive findings of physical examination then were enlargement of the *left* lobe of the thyroid gland; hyperactive deep reflexes, particularly marked in the patellar reflexes; weakness of the hands and arms, with greatly impaired ability to dorsiflex the hands and elevate the arms; positive Babinski sign bilaterally; slight labial ataxia; exophthalmos; external strabismus; and right hyperphoria. The heart and lungs were considered normal. Re-

sults of a urinalysis, blood count, blood Wassermann test, and X-ray examination of the skull were not abnormal. The diagnosis suggested by the examiners at that time was amyotrophic lateral sclerosis, but it was not substantiated by the subsequent course.

The muscular weakness of the extremities apparently subsided spontaneously, but the enlargement of the thyroid, the exophthalmos, and the nervousness persisted. Examinations in 1924 and in 1925 indicated that the *left* lobe of the thyroid remained more enlarged than the right. Von Graefe's sign and Moebius's sign were present, in addition to the exophthalmos, but the eyeball movements were normal. The ptosis was not evident at that time.

In 1926, the eyes were reported *entirely normal* by a competent ophthalmologist; there was no exophthalmos, no ptosis, no strabismus, no abnormality in the fundus. The patient's basal metabolic rate that year ranged about plus 5 percent, and a note was made that there was no clinical evidence whatsoever to indicate thyrotoxicosis, and that examination of the nervous system was entirely negative for evidence of gross organic disease. By 1930, even the enlargement of the thyroid gland and the tremor had disappeared, and the patient considered himself in relatively good health, although exophoria of the left eye had developed.

In 1932, while the patient was recuperating from the cholecystectomy, ptosis of the right lid developed gradually over a period of about one month, and ptosis of the left lid developed two months later. The bilateral ptosis persisted, and the patient elevated his lids with adhesive tape strapped to the forehead. The exophthalmos recurred, and the *right* lobe of the thyroid gland became enlarged. Tremor and hyperactive deep reflexes were again noted. The presence of these

features, plus tachycardia and dermographia, prompted the attending physicians to return to the diagnosis of hyperthyroidism.

In 1938, the patient noticed the recurrence of generalized weakness, but he remained ambulant. In 1940, transient blurring of vision and diplopia occurred and spontaneously subsided. Exertional dyspnea and palpitation again developed, but there was no orthopnea, ankle edema, or precordial pain.

Since February, 1942, the patient had noticed that his weakness was becoming more pronounced; his voice became weak and hoarse, and ingested food was sometimes regurgitated through the nose. There had been a gradual weight loss of 47 pounds since 1924. These difficulties persisted, and the patient presented himself for admission at the U. S. Marine Hospital on June 30, 1942.

**PHYSICAL EXAMINATION.** The patient was an elderly white male, fairly well developed but in a poor nutritional state, appearing chronically ill; height 65 inches, weight 115 pounds. Orientation in time, place, and person was accurate, and there was no discernible impairment of judgment or insight. Anxiety, general somatic hypermotility, and a coarse tremor of the fingers and tongue were apparent.

**Ocular examination.** Moderate bilateral exophthalmos and complete bilateral ophthalmoplegia externa (including the levators palpebrae superioris) were present (fig. 1). The distance from the external canthus to the apex of the corneal surface was 18 mm. on the right, and 19 mm. on the left, by gross measurement. (Exophthalmometric determinations were not available.) There was no eyeball motion whatsoever. Slight edema of the lower lids was evident. The patient elevated his upper lids with adhesive tape attached to the forehead, in order to counteract the

ptosis. Ophthalmoscopic examination of the fundi was negative, the discs, vessels, and retinas appearing normal. Pupillary reactions were normal. The visual acuity was 20/20 in each eye. Determination of perimetric field vision indicated a very slight contraction of the visual fields. The patient was not aware of the paralysis of eyeball motion.

*Trunk.* The neck veins were dilated but

base. The rhythm was wholly irregular, auricular fibrillation, and there was a pulse deficit of 34 beats per minute (ventricular rate 154 per minute, pulse rate 120 per minute). The blood pressure was 148/80.

The abdomen was normal except for a long right rectus scar covering a small incisional hernia. The extremities, genitalia, and rectum were normal.



Fig. 1 (Fagin, Pagel, and Sand). Anterior and lateral photographs of the patient reported, demonstrating an enlargement of the thyroid, the ptosis, and the exophthalmos (partially masked by the ptosis).

did not fill from below. The *right lobe* of the thyroid was enlarged to the size of a lemon, displacing the trachea to the left, and felt soft and cystic. No *bruit* was audible over the thyroid. The lungs were clear to clinical examination. The heart was enlarged to the left and downward, the point of maximum intensity being in the 6th intercostal space at the anterior axillary line. The sounds were loud and forceful, and the aortic second sound was louder than the pulmonic second sound. A loud, long, blowing systolic murmur was audible maximally at the apex and was transmitted medially to the left border of the sternum, and upward to the

*Neurologic examination.* (a) Cranial nerves: The ophthalmoplegia externa has already been noted. Other cranial nerves were normal. The patient spoke with a hoarse voice but oral and laryngoscopic examination revealed no abnormality of the nasal, palatal, or laryngeal muscles or mucosae. The vocal cords appeared entirely normal. (b) Sensory status: normal. (c) Motor power: generalized weakness of mild degree without any paresis or paralysis (other than the oculomotor) was present. This weakness was not affected by an injection of prostigmin administered to rule out any element of myasthenia gravis. Gait was normal, ex-

cept as modified by the weakness. (d) Cerebellar function: normal. (e) Reflexes: The deep reflexes were equal and slightly hyperactive. Abdominal and cremasteric reflexes were normal. Plantar reflexes were normal on the left, but exhibited a Babinski type of response on the right which, however, was not constant.

*Laboratory data.* Urinalysis, blood counts, erythrocyte-sedimentation rate, blood-sugar, and nonprotein-nitrogen determinations were all entirely normal. The basal metabolic rate was plus 65 percent. Spinal puncture was productive of clear, colorless fluid under normal pressure and with normal dynamics, normal cell count, and protein content (25 mg. percent). The blood and spinal fluid gave negative Kahn reactions. Gastric analysis revealed absence of free hydrochloric acid, even after the injection of histamine. Roentgenograms of the skull revealed no significant abnormality.

Roentgenographic examination of the chest indicated slight cardiac enlargement as gauged by the cardio-thoracic ratio (transverse diameter of heart, 14.7 cm.; transverse diameter of chest 27.7 cm.). However, the contour of the heart and the aorta, and the lung fields were normal.

*Clinical diagnoses.* 1. Thyrotoxicosis. 2. Cardiac disease: (a) thyrotoxic; (b) enlarged heart; (c) auricular fibrillation; (d) II; (e) C. 3. Cystic adenoma of the right lobe of the thyroid gland. 4. Exophthalmic ophthalmoplegia. 5. Incisional hernia.

*Course.* In view of the rapid fibrillation and the generalized weakness, digitalis was administered, and effected a decrease in the ventricular rate to 86 beats per minute with a pulse deficit of 6 beats per minute. After digitalization, the basal metabolic rate was plus 32.5 percent. Lugol's solution was then administered daily for a 10-day period, the basal metabolic rate falling to plus 17 percent. Coin-

cident with these decreases in the basal metabolism, the patient reported improvement in strength, decrease of anxiety, and disappearance of palpitation. With a view toward decreasing the strain on the patient's heart, thyroidectomy was considered advisable, despite the duration of symptoms, and an operation was performed under local anesthesia on July 31, 1942. The day following the operation, the patient exhibited collapse, dyspnea, dullness and absent breath sounds over the right lower lobe, and a low-grade fever (37.8°C.). These difficulties were attributed to a postoperative collapse of the right lower lobe, and bronchoscopic aspiration yielded one ounce of thick mucopurulent secretion. Following the aspiration, breath sounds were audible over the right lower lobe, but the patient continued progressively downhill, expiring on August 2, 1942, two days postoperatively.

*PATHOLOGIC ANATOMY.* *Thyroid.* The thyroid gland removed at operation evidenced enlargement of both lobes, more pronounced on the right side, and weighed 64 grams. The surface of the gland was nodular, and, on sectioning the gland, the nodules were found to vary from 0.5 to 1.5 cm. in diameter. Fresh hemorrhage had occurred into some nodules, while others had a colorless, almost translucent appearance. A small area of calcification was present in one nodule. The fibrous tissue about some of the nodules appeared quite thick.

Microscopic examination of thyroid sections indicated that the nodules, apparently by their expansive growth, had compressed the thyroid tissue at their margins into a thick capsule-like structure (fig. 2). The acini within the nodules varied considerably in size, but papillary proliferation of the epithelium was not evident. However, most of the epithelial cells were of the high columnar type. The colloid immediately next to the lining cells ex-

hibited vacuolization, but was otherwise homogeneous and heavily staining in type. In some nodules foci of degeneration were evident wherein the acini were widely separated by a lightly staining, almost acellular ground substance in which an occasional small nidus of thyroid cells was observed. The colloid material in degener-

The heart was dilated and enlarged, weighing 400 grams. All chambers appeared enlarged, but the left auricle was tremendously dilated. The myocardium was firm, red-brown in color, and showed no scarring. Slight atherosclerosis of the mitral valve and of the aorta was evident, but the coronary arteries were normal. The right ventricular wall measured 4 mm. in thickness, the left measured 13 mm.; the right auricle measured 3 mm., the left 4 mm. The



Fig. 2 (Fagin, Pagel, and Sand). Section through the thyroid gland ( $\times 100$ ) demonstrating colloid retention, variability in size of acini, and compression of thyroid tissue to form a thick pseudocapsule.

ating portions of nodules was more lightly stained than other portions.\*

**POSTMORTEM EXAMINATION.** *Gross anatomy.* The body was that of a middle-aged white male, 65 inches long and weighing 115 pounds. Postmortem rigidity and lividity were evident. Slight exophthalmos was present. Edentia, a recent operative scar of the neck, and a well-healed right rectus scar were noted on external examination. Superficial lymph nodes were not palpable. The body was opened by a Y-shaped incision. There was no increase in free fluid in the peritoneal, pleural, or pericardial cavities, and the serous surfaces were normal. The thymic fat pad was not enlarged.

tricuspid ring was 12 cm. in circumference, the pulmonic ring 7.5 cm., the mitral ring 10 cm., and the aortic ring 8 cm. Microscopic examination of the heart was normal except for the deposition of a moderate amount of yellow granular pigment at the poles of the nuclei. Slight atherosclerosis and intimal fibrosis were seen in sections of the aorta.

The right lung weighed 850 grams, and the left 950 grams. The lower lobes of both lungs (particularly the right) were almost completely consolidated, and the small areas which were not consolidated were extremely congested. The other lobes were crepitant and of the usual gray-red color lightly mottled with black. The bronchi were congested and contained thick

\* Professor H. M. Trumbull in his report on the examination of five thyroid glands removed from patients in Brain's series states that these glands exhibited more evidence of colloid retention and less evidence of colloid secretion or transference than goiters characteristic of Graves's disease. The thyroid from our case would also fit into this group.

muroid material. On microscopic examination, the alveoli showed varying degrees of polymorphonuclear leucocytic infiltration and minimal amounts of fibrin. Many of the alveoli in addition showed the lightly staining albuminous precipitate from edema fluid. The areas of consolidation varied in size and were mixed with areas of hemorrhage. The bronchioles were filled with purulent material.

Grossly, the other viscera were normal, except for slight enlargement and increase in the consistency of the liver.

hemorrhage into the perivascular spaces. The pituitary gland was normal microscopically.

The right eye was removed from the orbit, and the orbital fat was found to be firm and faintly lobulated. The external ocular muscles were thin and pale. Microscopic examination of sections of the orbital fat revealed no abnormalities. The external ocular muscles showed varying degrees of degeneration. A hyaline or Zenker type of degeneration was the most common type found. In the degenerated areas, the cross-striations and longitudinal striations

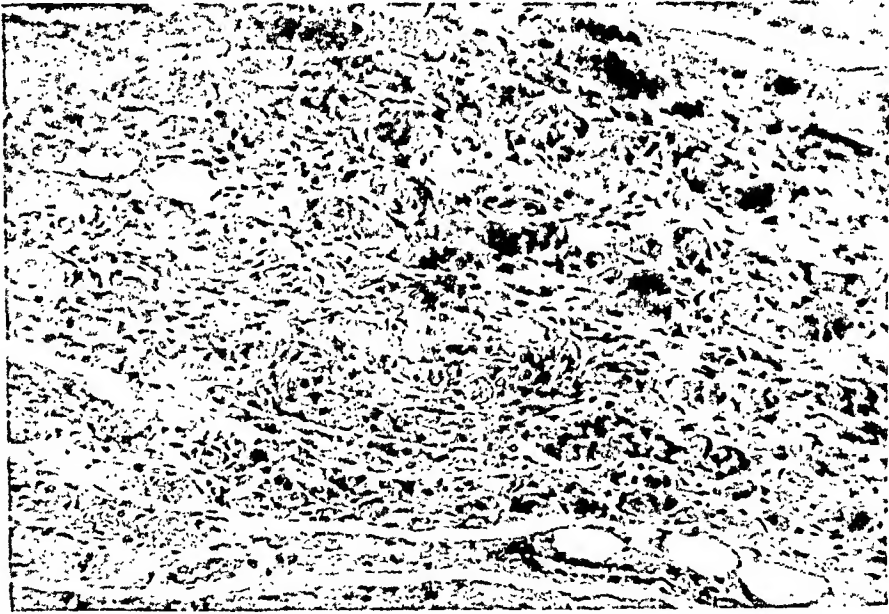


Fig. 3 (Fagin, Pagel, and Sand). Section through an external ocular muscle ( $\times 100$ ) from the case reported. The hyaline degeneration and delicate fibrosis are evident. Compare with figure 4.

Microscopically, the liver revealed irregular congestion; other organs, including the thymus, were normal.

The vessels at the base of the brain exhibited a slight degree of arteriosclerosis, and the leptomeninges showed pronounced fibrosis, with hyperemia of the anterior two thirds of the leptomeninges. The Pacchionian granulations extended more laterally than usual. The lateral ventricle and third ventricle were slightly dilated, and the foramen of Monro was widely patent. A few petechial hemorrhages were seen in the anterior portions of the frontal lobes. On the right side there was destruction of a portion of the gyrus hippocampi involving the horn of Ammon. No other focal lesions were found in the cerebral hemispheres. Intensive examination of sections through the brain stem failed to reveal any significant abnormality. The pituitary gland was of normal size. Microscopic examination of the brain revealed only an occasional recent

were no longer visible, and in many places the fibers had degenerated to a round or oval hyaline mass with 3 to 6 nuclei at the margin. These masses took the stain more darkly than did the few normal fibers that remained. Occasional foci of lymphocytic infiltration were scattered through the external ocular muscles, and in the degenerated portions of the muscles there was a delicate and diffuse fibrosis enclosing the many small hyaline masses (figs. 3, 4).

ANATOMIC DIAGNOSES. 1. Nodular colloid goiter. 2. Enlargement and dilatation of the heart. 3. Bronchopneumonia. 4. Exophthalmos, bilateral, slight. 5. Passive congestion of the liver. 6. Degeneration and fibrosis of the external ocular muscles. 7. Emaciation.



## DISCUSSION AND COMMENT

The case history presented is of equal interest to the internist and ophthalmologist. The long duration of the symptoms of hyperthyroidism and the variability of the symptoms are unusual. Apparently, the symptoms of hyperthyroidism first developed in 1916, subsided by 1926, re-occurred in 1932, and persisted until death.

patient had taken iodine or other medications at any time previous to his admission to the U. S. Marine Hospital.

The variability in the ocular signs is another unusual feature of this case. It is not certain when the ophthalmoplegia developed, since the patient was not aware that he suffered therefrom. However, it is likely that paralysis of the external ocu-

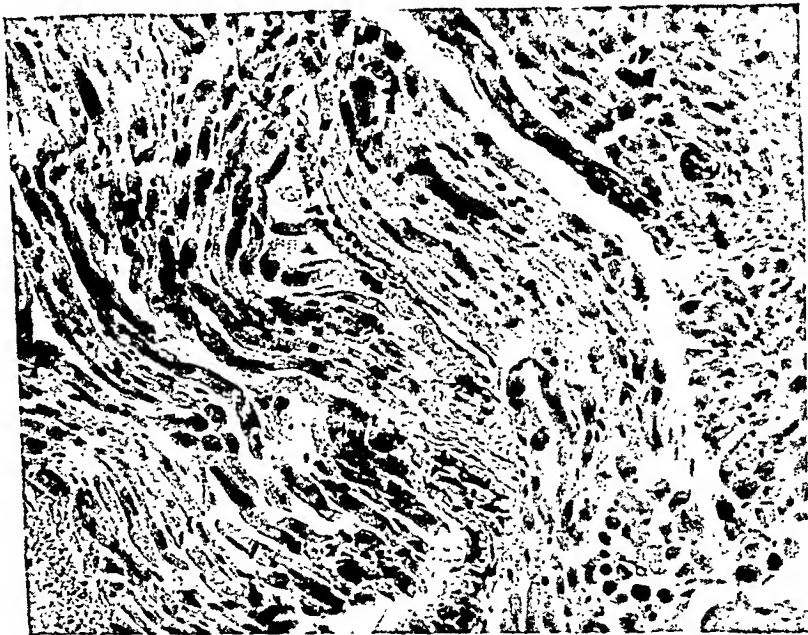


Fig. 4 (Fagin, Pagel, and Sand). Section through a normal external ocular muscle ( $\times 100$ ).

It is difficult to understand why the patient was not subjected to thyroidectomy earlier in the active phases of his disease.

The variability in the enlargement of the thyroid is another interesting feature in this history. Apparently, the first manifestation of dysfunction was a diffuse swelling of the gland, followed later (1922) by enlargement of the *left* lobe of the thyroid gland. Subsequently the enlargement became symmetrical, but in 1932 with the recurrence of the symptoms of thyrotoxicosis the *right* lobe of the gland became enlarged. The latent periods were apparently spontaneous in development since there was no history that the

lar muscles began to develop in 1940, with the transient diplopia, which was probably secondary to an initial asymmetrical paralysis.

The term "*exophthalmic ophthalmoplegia*" is descriptive of the clinical features of this entity; that is, protrusion of the eyeball in association with paresis or paralysis of the ocular muscles. The ophthalmoplegia is chronic, generally progressive, and is of the *externa* type, involving only the external ocular muscles. The causes of chronic ophthalmoplegia externa have been reviewed recently<sup>2</sup> and they fall into the following etiologic categories: 1. Cranial trauma. 2. Intracranial



and systemic infections. 3. Increased intracranial pressure. 4. Cerebral circulatory disorders. 5. Poisonings and miscellaneous causes. Exophthalmic ophthalmoplegia is included in the poorly defined miscellaneous group since its cause is unclear.

Brain and Trumbull,<sup>3</sup> in a comprehensive review, discuss the clinical and pathologic aspects of exophthalmic ophthalmoplegia from personal observation of 31 cases. Briefly, the exophthalmos and ophthalmoplegia may develop in one or both eyes, the protrusion being more often asymmetrical, either spontaneously during a period averaging about three to four months in a patient with no or minimal constitutional signs of thyrotoxicosis, or within a few days to two years after subtotal thyroidectomy performed on thyrotoxic individuals.

During the development of the oculomotor paralysis, the patient may notice diplopia as a result of asymmetrical involvement. The exophthalmos of exophthalmic ophthalmoplegia is usually of greater degree (averaging 7 mm.) than that encountered in hyperthyroidism (averaging 2.5 mm.) as gauged by exophthalmometric observations. Some edema of the lids generally accompanies the exophthalmos and even papilledema may develop. Unilateral or bilateral ptosis was present in about 25 percent of Brain's patients. The manifestations of thyrotoxicosis (palpitation, nervousness, weight loss, enlargement of the thyroid gland, tremor, tachycardia, elevation of basal metabolic rate, and other features) are usually mild. The prognosis is generally poor. The exophthalmos and ophthalmoplegia attain a maximum in a few months, and then remain stationary or regress only partially, with resultant disfigurement and limitation of ocular function. Treatment by thyroidectomy, irradiation of the thyroid and pituitary

glands, ovarian hormones, or thyroid extract is unsatisfactory in the great majority of instances. For cases exhibiting extreme exophthalmos, Naffziger's orbital decompression operation may be helpful.

The relationship between exophthalmic ophthalmoplegia and the state of function of the thyroid gland is confusing. The evidence *against* any direct causal relationship between thyroid hyperactivity and exophthalmic ophthalmoplegia is impressive, and may be summarized as follows: (a) Exophthalmos alone, or exophthalmos associated with ophthalmoplegia, may develop or increase<sup>1,3</sup> following thyroidectomy, when the patient clinically is in a *hypothyroid* state, and the basal metabolic rate is normal or subnormal. (b) The symptoms of hyperthyroidism found in association with exophthalmic ophthalmoplegia are usually mild in degree. (c) The administration of thyroid extract or of thyroxine to patients with obesity, myxedema, or goiter very rarely produces exophthalmos.<sup>4</sup> In those rare cases where it does develop, the general picture is one closely similar to exophthalmic goiter, so that the exophthalmos cannot be attributed directly to the thyroid extract. (d) The exophthalmos of exophthalmic goiter may precede the constitutional symptoms of thyrotoxicosis, and even if the hyperthyroid state is terminated by extirpation of the gland or by spontaneous subsidence, the exophthalmos generally persists and may become even more severe. (e) The age and sex incidence of exophthalmic goiter and of exophthalmic ophthalmoplegia are different.<sup>5</sup> Exophthalmic goiter affects females more frequently than it does males—in the ratio of 9 to 1; in exophthalmic ophthalmoplegia, this female preponderance does not exist. The average age of patients with exophthalmic goiter is in the middle thirties, that of patients

with exophthalmic ophthalmoplegia is in the late forties. (f) Smelser<sup>5</sup> reported that the injection of anterior pituitary extract (containing thyrotropic factor) produced exophthalmos regularly in thyroidectomized guinea pigs. Friedgood<sup>6</sup> also found that exophthalmos was more readily produced by anterior pituitary extracts when the guinea pigs were in a state of thyroid deficiency. Similarly, Marine<sup>7</sup> found that exophthalmos was more readily produced in rabbits by methyl cyanide after thyroidectomy.

These findings militate rather strongly against ascribing any direct causal relationship to the thyroid in exophthalmic ophthalmoplegia. The problem is complicated by the complexity of the interrelationships between the endocrine glands. It has been shown in experimental animals that exophthalmos can be produced by the injection of anterior pituitary extract<sup>5,6,7</sup> even in thyroidectomized animals. Whether human exophthalmos is due to an increased secretion of the thyrotropic factor of the anterior pituitary hormone, or to a decreased secretion of active antithyrotropic factor, or perhaps to both, is not clear. Marine<sup>7</sup> has suggested that exophthalmos (in guinea pigs, at least) may be due to excessive anterior pituitary secretion acting directly on a sympathetic center in the hypothalamus, or acting indirectly through the gonads on that center. However, that theory does not appear tenable in the light of Smelser's finding<sup>5</sup> that removal of the cervical sympathetic ganglion does not prevent the development of exophthalmos in guinea pigs. Another difficulty is that excessive thyrotropic activity has not been demonstrated in the blood or urine of patients with thyrotoxicosis.<sup>8</sup>

A significant addition to the study of exophthalmos was made by Smelser's observations of the orbital tissues.<sup>5</sup> He found that in both experimental and hu-

man exophthalmos the orbital tissue was excessive in amount, the retrobulbar connective tissue, the fat, and the external ocular muscles being edematous and infiltrated with wandering cells. The exophthalmos was attributed to the mechanical effect of the increased orbital tissue. We were unable to demonstrate edema of the orbital tissues or of the external ocular muscles in the case reported here.

Brain and Trumbull<sup>3</sup> ascribe the exophthalmos to an increase in pressure in the fat-containing cone formed by the globe and the external ocular muscles, the posterior surface of the globe forming the base, the muscles forming the sides, the muscular attachments to the bony orbit forming the apex. The increased pressure presumably results in mechanical restriction of the motion of the eyeball, and interference with venous drainage results in edema of the muscles and orbital tissues. McGregor<sup>1</sup> postulates that cellular infiltration of the orbital tissues then occurs, which, together with the edema, results in an increased volume of orbital contents, with subsequent degeneration of the muscles. That such a hypothesis, although teleologically satisfactory, is not completely adequate is indicated by its failure to explain the ophthalmoplegia in such cases as that reported by McGregor himself, wherein the paralysis preceded the exophthalmos by three months.

A somewhat different explanation is tendered by Galli-Mainini,<sup>8</sup> based on the probability that there is a tendency toward the development of edema in hyperthyroidism (resulting from increased pulse pressure, subnormal serum-protein levels, capillary dilatation, and increased capillary permeability). These *edematogenic* factors, acting with myasthenia of the oculomotor muscles, result in an increase of volume and pressure in the orbit, and exophthalmos. Degeneration and lymphocytic infiltration of the extra-

ocular muscles presumably causes the ophthalmoplegia.

The treatment of exophthalmic ophthalmoplegia is a difficult clinical problem. It has been stated that thyroidectomy is the measure most definitely contraindicated in Graves's disease with dissociation of thyrotoxicosis and ophthalmopathy,<sup>9</sup> and the treatment recommended is to lower the basal metabolic rate with iodine to as low as it will go and then add thyroid hormone. Means and co-workers<sup>9</sup> point out that the metabolic action of the thyroid and the iodine will cancel each other, but it is the diuretic effect of thyroid that is desired in order to reduce orbital swelling. In the patient presented

in this report, the thyroidectomy was considered advisable because of the cardiac factor; however, in retrospect, in view of the good response to the administration of digitalis and iodine, perhaps it would have been wiser to have continued those measures, and, if necessary, to have irradiated the thyroid later.

#### SUMMARY

1. The clinical history and findings of postmortem examination of a patient with exophthalmic ophthalmoplegia are reported.

2. The syndrome of exophthalmic ophthalmoplegia is briefly reviewed.

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# DUTIES AND TRAINING OF AN ORTHOPTIC TECHNICIAN

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It is clear that before planning a suitable course of study and training for an orthoptist we must come to some agreement as to the proper functions or duties of an orthoptist. It seems to me that the proper or specific sphere of the orthoptist is the dealing with disturbances of binocular vision and ocular motility and the teaching and training of the patient in the proper use of the two eyes by means of special exercises—"Reëducation of the brain to use the two eyes together," to quote Miss Billingham. It may be a matter of convenience to add other duties to this, her proper field, but for the purposes of fruitful discussion these supernumerary activities should be omitted. I have no quarrel with those who wish their flutist to double in brass and who therefore seek an orthoptist who is a perimetrist, a diagnostician, or even a refractionist or an expert in dealing with reading difficulties or an office nurse. What I am insisting upon is that these are not a part of the proper, or specific, exclusive sphere of the orthoptist.

In her capacity as an orthoptist it seems to be generally agreed that she should act in coöperation with, and under a certain amount of supervision by, an ophthalmologist. It is the proper or specific sphere of the ophthalmologist to make the diagnosis and plan and supervise the treatment. However, he can delegate certain details to assistants; one may measure the refraction, another may measure the motility. Just as the surgeon delegates the details of administering a general anesthetic to a specially trained anesthetist who is given rather a free hand, and as the laboratory technician is given a free hand in carrying out a requested blood test, so when the ophthalmologist

decides that orthoptics is indicated he need not specify what in detail should be done by the orthoptist. If he is wise he will leave that to one who knows much better than he how to deal with the details. If the ophthalmologist makes any bluff of pretending to know, he may be sure the orthoptist will see through it very easily and he will be given a corresponding place in her estimation—she is usually a good diagnostician in that field.

But the ophthalmologist should weigh the data furnished him and plan the treatment, whether by wearing glasses, perhaps with prisms, by orthoptic exercises, by operation (and if so what operation and when), and by postoperative training.

From this it follows that diagnosis is not the function of the orthoptist except in a limited but very important way. This consists in making certain measurements of function or performance.

## FUNCTIONS OF THE ORTHOPTIST

*The orthoptist makes certain measurements:*

(1) Visual acuity of each eye, separately and together, with and without glasses (bears on amblyopia, on alternating, on possibility of progress).

(2) Sometimes measures range of accommodation: Positive by —sph. and the near point of accommodation; negative by +sph.

(3) The deviation, whether phoria or tropia: A, by inspection (cover test and prisms); B, by instruments (amblyoscope, and other apparatus).

(4) Retinal correspondence and projection, normal or anomalous.

(5) Binocular vision analyzed according to the three established grades,

(6) Suppression must be investigated (very important).

(7) After determination of the deviation and fusion status, the amplitudes should be measured.

(8) Psychology: Patient's grade of intelligence, ability to cooperate, to concentrate. Patient's stage of growth (maturity); need of discipline; planning rewards. Mother: intelligence; cooperation; possibility of home treatment.

(9) The case must be analyzed and the problem clearly perceived as it exists at the present stage.

(10) Decide on the line of treatment. Have something definite in mind as the first goal. Work with precision toward the needs of the individual. Avoid haphazard fumbling. Avoid routine ruts. Avoid waste of time on what patient has already learned or what he is at present incapable of doing.

There are refinements of diagnosis important to the orthoptist but having little bearing on the treatment given by the ophthalmologist. For example, it is very important for the orthoptist to evaluate the patient's intelligence and actual capacity for cooperation; can he or, if he can, will he look at an object when told to? Some are not old enough to cooperate sufficiently to do this, some need discipline. Is the patient himself, or is his mother, capable of carrying out homework? If this is not diagnosed correctly much time and futile effort may be expended.

There are refinements of diagnosis important to the ophthalmologist but having little bearing on the treatment given by the orthoptist.

The ophthalmologist may wish to know the deviations as measured in the nine cardinal positions of gaze (often spoken of as six), though these rarely have any bearing on the work of the orthoptist who is satisfied to know the deviation in the

primary position for distance and near and occasionally looking to the right, to the left, up, and down. I feel that much time is expended on irrelevant, unnecessary (though not uninteresting) measurements when the orthoptist might be much better employed otherwise.

#### WHAT MAY THE ORTHOPTIST EXPECT OF THE OPHTHALMOLOGIST?

*The ophthalmologist should report to the orthoptist:*

(1) Findings with the ophthalmoscope, especially those bearing on amblyopia.

(2) Visual acuity, with and without correction.

(3) Refraction.

(4) Deviations, nature and etiology of deviations, if known. This is outside but close to the field of the orthoptist, who is not to be expected to be competent to investigate this problem but who may profit greatly from information which will help in making the prognosis, help her to answer the difficult question: How long will it take to cure this patient? (An important theme for research: Why do some get well in a few weeks while others, who appear similar at the start, take months?)

(5) History of treatment: Occlusion, glasses, orthoptics, operations, with details. Important information best furnished by the ophthalmologist rather than by the orthoptist by questioning the patient or mother.

(6) Conference or consultation, at least by telephone, at different stages of progress.

(7) Finally, the ophthalmologist should have sound and correct conceptions of the nature of the orthoptist's work. There are still many ophthalmologists who cling to the conception that disturbances of motility are due fundamentally to "muscle trouble"—some mus-

cle is weak or some muscle too strong. Inevitably they think of the orthoptist's work as trying to strengthen some weak muscle. The teacher of piano playing requires hours of practice playing scales and five-finger exercises, not to strengthen the muscles of the fingers and arms. The best player is not the one with the strongest muscles but the one who has the skill to use them. Proper use of the eyes is something that can be taught.\*

#### WHAT SHOULD BE THE RELATIONS BETWEEN OPHTHALMOLOGIST AND ORTHOPTIST?

(1) The ophthalmologist is in charge and entitled to dictate.

(2) Ideally, conference and consultation between the two should prevail, since each can contribute to solving the problems, each knows things the other does not know.

(3) When the ophthalmologist assumes the role of superiority the best way for the orthoptist is to assume the role of humility (and pity) but proceed, by deeds and by achievement impossible to the ophthalmologist, to show him the better way. Do not start by antagonizing him, leave him a chance to save his face.

(4) The ophthalmologist who would get the most out of the orthoptist should give her a free hand, offering suggestions in a friendly way, not in a dictatorial way.

(5) If there are differences of opinion, an attempt should be made to solve them by intelligence and discussion. Nothing is finally settled until it is correctly settled.

Having outlined the duties of the orthoptist, one is now prepared to take up the question of training or preparation of the orthoptist. As in the training of the

ophthalmologist, it will be found that since many, very many things will be useful the chief problem is the relative importance or value of different subjects. Where should the emphasis be placed? Time devoted to this must be taken from that.

First of all, it is to be hoped that some consideration will be given to aptitude. Is the person of a type likely to be successful as an orthoptist? The mere fact that she is fond of children is not enough, this might do for a nursery maid. It requires a fairly high degree of mental equipment plus the training—preorthoptic and orthoptic—to make a good orthoptist. Mediocre intelligence will not shine in orthoptics.

#### TRAINING OF THE ORTHOPTIST

##### WHAT IS THE BEST PREPARATORY (PRE-ORTHOPTIC) COURSE?

Training as a nurse, secretary, or laboratory technician does not offer the best basis for orthoptics. But the normal-school teacher, or one who has majored in psychology at college, or one experienced in kindergarten work has an advantage over even the graduate in optometry or in medicine.

##### ESSENTIALS OF A COURSE IN ORTHOPTICS

*Anatomy and Embryology.* One can be a good orthoptist with only a smattering of anatomy of the ocular muscles and their blood and nerve supply—quite different from the ophthalmic surgeon. The orthoptist needs to know enough about the muscles to understand what the surgeon is trying to accomplish by his operations and to be able to give him good advice regarding operations. Thus she needs to know the different types of operation. She soon learns who among the surgeons get good results.

*Physiology* is very important, since orthoptics deals with functions and with

\* See paper on "The role of exercises in ophthalmology." Trans. Amer. Acad. Ophth. and Otol., 1943.

reflexes in particular. A knowledge of the physiology of muscle, of nerve is important; also of the reflexes, conditioned reflexes. The secretions and the circulation are relatively unimportant. In physiology the instruction should be highly selective and specialized to fit the need of the orthoptist and give her a sound background so that she can understand the working of the visual organs, their possibilities, and their limitations. A smattering of *optics* (less even than that of the average ophthalmologist) is sufficient; also a smattering of lenses and prisms.

*Physiologic optics.* Training in this subject should include a smattering of *errors of refraction*. The student of orthoptics should know something of *accommodation*, especially the near reflex, which involves the accommodation, the pupil, and convergence. The study of *visual acuity* should comprise foveal and peripheral vision; the influence of age (infancy) on vision. A knowledge of *amblyopia*, *scotoma*, *suppression of small or large area of the retina* is recommended. *Binocular vision*, its three grades, should be studied: the states of development in infancy and childhood; corresponding and disparate points; fusion, motor and sensory.

The field of *ocular movements* should cover: *monocular*—fixation, reciprocal innervation; *binocular*—diplopia, fusion reflex, diplopiaphobia. Ocular muscles never work singly; effect of deficiency of a single muscle. All of the ocular muscles very strong, 100 times as strong as needed to move the eye. Innervation to ocular muscles always equal to both eyes. The two eyes act as a single organ, the binocular.

*Psychology* is very important, especially applied psychology, covering growth and maturity; habit formation and control; learning (a large chapter); attention—capacity for concentration—influ-

ence of age; parents and home life; discipline—fears, rewards; application of teaching methods to orthoptics, especially elementary teaching—for example, methods of teaching spelling, reading, and so on; how to win the patient's confidence and coöperation—for example, by explaining the nature of the defects and the way the training achieves results and some of its limitations, and like factors.

Parents and intelligent patients are eager for such instruction and have a right to expect it. If the doctor does not give it (and he may not have the time) he should welcome the aid of the orthoptist in this important but much-neglected work. As a teacher, she should be well fitted to teach the parents. If people are not taught by someone who knows, how are they to avoid the specious claims of charlatans or even of honest but ignorant practitioners? Moreover, patients crave understanding of their troubles. They wish to know why they are afflicted, what the causes are, what the remedies are, what the outlook will be. It is not easy to answer these questions when the questioner is as ignorant as most of them are. Hence some doctors fall back on easy evasions or sweeping generalities or old-time popular pathology, "The patient has a lazy eye or lazy muscle." Then if the orthoptist makes the matter clearer in plain language the patient or the mother thinks the orthoptist knows more than the ophthalmologist. Perhaps they are right.

#### PRACTICE

The student should become familiar with: (1) the technique of the use of the instruments; (2) analyzing the visual problems; (3) planning treatment for specific problems; (4) discipline; (5) handling parents; (6) home work. It is not enough to tell the patient *what* to do—for example, bar-reading, which is often very difficult to accomplish correctly.



The influence of age is well illustrated by the progress of a child with convergence. He makes fairly good progress until he gets down to 10 degrees. There he often sticks discouragingly. He suppresses in spite of you, but when he learns to read he can be taught not to suppress and makes rapid progress.

(7) Reporting to doctors. The orthoptist has duties to satisfy the doctor, the parents, the patient.

The doctor wants to know if this case is one orthoptics will cure. He should (and would if he were wise) want the opinion of the orthoptist as to various matters of treatment including when to operate. He wants the patients to have confidence in him, hence the orthoptist must be very wary in her frequent conversations with the parents and the patients, striving to build up their confidence in the doctor, ready with explanations as to why operation is done or not done, "Trust the doctor, it is his job to decide such questions." "I have seen some splendid results with his cases." "He has had great experience in such cases." Unfortunately, patients are often keen enough to perceive that the doctor knows much less about his particular case than the orthoptist, who, of course, sees him 10 times to the doctor's one. However, some doctors prefer an orthoptist who does not know so much.

*The orthoptist's duties to the parents cover:*

- (1) Explanation of the problem and of the treatment. The parents have more frequent contact with the orthoptist, become less afraid to ask her questions, and are very grateful for such information. To refuse it could have a bad effect on the relations between parent and orthoptist.
- (2) Instruction in home coöperation.
- (3) Satisfactory discipline.

*The orthoptist's duties to the patient* call for (1) understanding and (2) more

understanding, (3) complete understanding. Factors are A, his age; B, his intelligence; C, his environment (note the marked change in attitude that comes soon after the child begins to go to school); how to manage motivation (rewards, praise, commendation, and the like as well as punishments); D, anatomic situation.

#### SUMMARY

Ophthalmologists, in planning the proper course of study for an orthoptist, have over-emphasized certain parts of such subjects as anatomy, optics, some branches of physiologic optics; they have under-emphasized some aspects of physiologic optics, and especially of psychology, the science and art of teaching, the behavior of children, the fundamentals of learning, of acquiring new habits and eliminating old ones. It is easy to see why this should have happened since the doctors naturally stress the subjects they know something about and the subjects they know from experience are important in their own work. Knowing little about orthoptics they do not know what to emphasize.

Far be it from me to belittle the importance of the basic subjects, I have been pleading for them for years. It is the *relative* importance that I am advocating. All education involves frequent choices. I can take this only if I omit that. Hence the crucial decisions are: What can or must be omitted? I submit that in the training of orthoptists the failures have been not in the basic ophthalmic subjects but in the basic subjects of psychology, the art of teaching, the laws of learning, the ways of habit formation of conditioned reflexes.

Another thought is that perhaps orthoptics in this country has become inbred and needs crossing with new and different ideas to become most fertile.

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## TREATMENT OF ASTHENOPIA—NONPATHOLOGIC AND NONREFRACTIVE IN ORIGIN

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A certain percentage of patients who consult ophthalmologists because of asthenopic symptoms are not relieved by glasses or other usual methods. Many of these give evidence of nothing that falls within the sphere of recognized diagnosis. A study of 125 of these difficult and dissatisfied individuals in our office leads us to believe that they manifest asthenopia from disturbed muscular coördination and/or fusional amplitude too small for classification, or spasm from muscles long held in restricted positions, passive congestion, and failure of smooth interaction of muscle and tendon, in relationship to adjacent tissues.

In our experience this group of 125 cases falls in a classification quite independent of the usual disturbances of coördination such as definite phorias and tropias, and they are seemingly all independent of refractive disturbance or intrinsic or surrounding pathologic factors. We believe there develops in many people a condition that disturbs the smooth, normal mechanical relationship of muscle and tendon and their coverings of tendon sheathes, Tenon's capsule, and the like, which produces various asthenopic symptoms. As muscles of the body generally become less pliable and interact with discomfort when not normally exercised, so the ocular muscles can, by assuming rather restricted action during long hours, become relatively fixed so that the movements less frequently required produce discomfort, as, for example, discomfort of the back muscles after bending over an operating table for prolonged periods.

Patients who do close work for long continuous periods sometimes are found to have in their eye muscles a condition

analogous to the aforementioned backache. These muscles have been held in a converged, or other position so long that the eyes do not relax for an uncomfortably long period; or else they become comfortably fixed in these long-held positions and produce discomfort on being moved to less usual positions. Symptoms of our patients varied from constant or frequent headaches in 53 instances, to tearing, blurring, twitching, and general visual discomfort in the remaining 55 complete cases studied.

An occupational survey of the 44 men and 64 women patients reveals that 45 were confined to offices, 27 were students, and, of the remainder, 22 were housewives, 9 were professional people, 3 were salesmen, and 3 were employed in factories. The age range was from 12 to 54 years.

Uncorrected refractive errors and other visual irregularities, sinus disease, and like affections, which may be factors in asthenopia were ruled out insofar as it was possible to do so. All but eight patients attained visual acuity of 20/20 in each eye. The exceptions had acuity of at least 20/50 in each eye.

A specific diagnosis of the causes of the asthenopia found in this group of cases seems to us exceedingly difficult. Some of the patients had difficulty in abducting or adducting their eyes, hence they might be characterized as having "poor ductions," or a disproportionate relationship between the prism diopters of convergence or divergence, low "amplitude of divergence and convergence," or "insufficient amplitude of fusion areas." There is a little difficulty here in that too little agreement has been found as to defini-

tions for these terms. Nor is the relationship which should exist between factors such as abduction and adduction agreed upon. It is generally stated, however, that a "reasonable amplitude of convergence" is necessary to comfortable vision. We assume that some of our patients suffer from a lack of "reasonable amplitude of convergence."

Other diagnostic phrases that have also been suggested are "minimal binocular coördination," "disturbed binocular coördination," and "insufficient fusion span." But here again we find ourselves at a loss for lack of standards for measuring purposes.

We reach our decision as to the needs of the patient without benefit of special vocabulary. Our "technique" is most easily illustrated by a few examples.

A patient seated before the Synoptophore cannot hold two unlike figures superimposed at or near his phoria point. When he attempts to use his eyes simultaneously his fixation is poor. Asked to fuse identical objects he suppresses either alternately or monocularly. If "print jumps and blurs before the eyes after a short period of reading" and if headache develops in spite of refractive correction and other visual procedure, we try a series of exercises. Some persons suppress constantly when a load is put on, thus eliminating the necessity of coördination.

Another patient has no difficulty holding his eyes steady, but although he can abduct and adduct for what seems a reasonable degree he does so only with great effort and fatigue. His eyestrain if not otherwise relieved is frequently overcome with carefully administered exercises. Take such a patient's muscle balance with the phoropter and he may seem normal in the usual hurried examination, but hold him to it and he may manifest considerable muscular difficulty.

A third patient has difficulty adjusting

accommodation and convergence quickly from one distance to another. He sees acutely after going through a period of conscious adjustment during which objects are blurred and occasionally double. A few exercises may make this adjustment more normal and comfortable.

As may be expected, a fair proportion of the cases classify themselves rather readily as convergence-insufficiency or -excess, or divergence-insufficiency or -excess problems. However, original phorias were normal in 80 instances, 15 patients were exophoric, and 13 were esophoric. No trophias were included. Original "ductions" findings were poor in 79 instances, fair in 26 instances, and 4 patients had excellent ductions before beginning exercises. All but one patient had stereopsis, although with 13 patients this was of a very low grade.

At the conclusion of remedial exercises, phorias were found to be essentially unchanged. Improvement in "ductions" varied from 5 to 25 prism diopters. However, the conclusion that this improvement brought comfort does not, except in a few cases, seem warranted.

It is generally acknowledged that the ability to compensate for or to ignore weaknesses varies markedly in persons, and it is not far-fetched to assume that a systematic exercising of the various ocular muscles may result in a general improvement in the mobility of the eye muscles to the extent that the specific difficulty, if not incidentally corrected, may be more easily overcome.

We subjected each of these patients to a series of orthoptic exercises designed to correct the particular types of weaknesses toward which each showed a tendency and/or in general just to limber up the muscles and improve circulation. Many of the patients received base-in and base-out exercises sometimes combined with accommodation, alternation, or rotational

exercises. Some were given exercises especially designed to stimulate fusion by the foveal area; others received binocular peripheral stimulation. Exercises were given at both near and far points. Most of the work was done with a Rotoscope supplemented with the Synoptophore, the Tele-trainer and the Junior Metronoscope with prism attachment. The exercise period varied from 15 to 25 minutes, depending upon the type of exercise given. A trained technician remained constantly with each patient during an exercise. We believe constant, intelligent direction to be essential to effective orthoptics, particularly when it is desired to give a minimum number of exercises.

The number of exercises given to the patients varied from 3 to 21. However, the optimum number seemed to be 6 exercises, the first 4 being given bi-weekly, the last 2 at intervals of a week.

Home exercises were prescribed for two thirds of the patients. In seven instances these were the conventional stereoscope exercises. The other two exercises used were the well-known finger-to-nose convergence exercises and an equally simple divergence device familiar to our patients as the "thumb exercise."

Since this "thumb exercise" is flexible, simple to teach, and amazingly effective as a "relaxing" device, a brief description of it seems warranted. To perform the exercise, hold up the right thumb, 13 inches in front with good illumination at the back. Looking through to infinity will produce physiologic diplopia and two thumbs are seen out of focus. Now arrange the left thumb beside, parallel, and level 65 mm. from the first. Four thumbs will be seen with a little practice; one can fuse the middle two thumbs and by asymmetric stereopsis project a third thumb. To exercise the lateral recti, gradually separate the two thumbs until the middle thumb is distorted against effort. The il-

lusion will be aided and fixation stimulated if a spot is marked on each thumb nail with India ink about 2 mm. lateral to the midline. This spot will then appear to stand out in relief an inch closer than the thumb nail. Patients to whom this exercise is prescribed usually perform it several times a day for periods not exceeding one minute.

Relief from asthenopia was complete and thus far permanent (the program was begun two years ago) as concerns 108 of this group of patients. In several instances comfort followed many years of headaches and visual fatigue, in spite of glasses and other usual therapeutic procedures.

Of the 125 cases included in the study, 17 patients did not respond satisfactorily to remedial exercises. Various factors such as poor coöperation, absence from treatments, and illness were present in these instances and may have contributed to the lack of success.

As massage may give much relief in general to congested, stiff, and painful muscles anywhere in the body, so the orthoptic department of any ophthalmologist's practice can serve in addition a most helpful purpose over and above the more definite procedures for which such exercises are more commonly used.

#### SUMMARY

A study was made of 125 cases of asthenopia in patients who were not relieved by glasses or other means. This group did not consist of those with definite muscular difficulties, such as definite convergence insufficiency and the like, but rather those who, for no apparent reason, had difficulty in doing sustained close work. The ages ranged from 12 to 54 years, with a mean age of 28. There were 44 men and 64 women in the completed cases; 27 were students, and of the remaining 37, 22 were housewives, 9 pro-

fessional people, 3 were salesmen, and 3 were employed in factories.

The vision in all but eight patients was 20/20 O.U., the others having at least 20/50 O.U. Orthoptic exercises varying from 3 to 21 sessions were given with the Synoptophore or other orthoptic instruments. Seventeen of the 125 failed to respond satisfactorily to remedial exercises. Poor coöperation and failure to take the optimum number of exercises, which was

found to be six, may have been contributing factors.

It is thought that as massage may give much relief in general to congested, stiff, painful muscles anywhere in the body, so the orthoptic department in any ophthalmologist's office can serve in addition a most helpful purpose over and above the more definite procedures for which such exercises are more commonly used.

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## NOTES, CASES, INSTRUMENTS

### CAVERNOUS-SINUS THROMBOSIS WITH RECOVERY

#### REPORT OF A CASE

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A soldier, 20 years old, was admitted to the Station Hospital on April 30, 1943, complaining of swelling of the nose and face, chills, and fever. Four days previously he had first noticed a small, red, painful swelling on the tip of his nose. This progressively increased to involve the upper half of the face at the time of hospitalization. Two days prior to admission he had had a shaking chill of 30 minutes' duration. Except for a mild sunburn no history of previous trauma or infection could be obtained.

Initial examination showed an acutely ill young, white, male complaining of painful swelling of the nose and face, the upper half of which was swollen, red, and tender. Although there was edema of the lids the eyes could be opened voluntarily, and there was no proptosis. The conjunctiva of the globes was moderately injected but not edematous. The pupils were round, equal, and reacted to light and accommodation. The eyegrounds appeared to be normal. Breathing was par-

tially obstructed by the swollen nostrils, from which exuded a small amount of serous discharge. The neck was not rigid. Petechiae and rash were both absent. Physical examination was otherwise negative. His temperature was 104.2°F., the pulse rate 122, and respirations 34 per minute. The white-blood-cell count was 13,200, with 92 percent polymorphonuclears.

A diagnosis of cellulitis of the face originating from a lesion on the nose was made.

A blood culture was taken on the first day and 5 gm. of sodium sulfadiazine in distilled water administered intravenously. Sulfadiazine—2 gm. every four hours—was given orally. Continuous wet boric acid dressings were applied locally.

The next day chemosis appeared and the edema of the lids became more marked. By the fourth day it was apparent that a bilateral cavernous-sinus thrombosis had developed. At this time the lids were so swollen that they could no longer be opened, and the ocular conjunctiva projected between the lids. Both eyes were proptosed and immobile. The supraorbital and palpebral vessels were markedly dilated. Fundus examination revealed engorged and tortuous veins. The optic discs were still well defined, with moderately

deep physiologic cupping. There were no retinal hemorrhages nor edema. Thick yellow pus was draining from three openings on the nose. The blood culture taken on the day of admission was reported positive for *Staphylococcus aureus haemolyticus* on May 3d, and sulfathiazole—2 gm. every six hours—was substituted for sulfadiazine. The patient became irrational and his temperature remained elevated. A white-blood-cell count of 20,000 was recorded at this time.

On the sixth day the patient was given a whole-blood transfusion (500 c.c. citrated). On the following day the swelling and induration has spread to the right mandible. Much of the ocular conjunctiva projected between the lids; drying was prevented by the use of a bland ointment and constant wet boric-acid dressings. On the same day he received 60,000 units of staphylococcus antitoxin (Lederle) intravenously and 40,000 on the following day. Twenty-four hours after the administration of the first of these treatments the patient's mental state improved and the temperature dropped to 101.4°F. From this day improvement was steady, with rapid recession of the facial edema. On the sixteenth day the dosage of sulfathiazole was reduced to 1 gm. every six hours and was discontinued three days later, after four days had passed in which the temperature was normal. The results of examination were now negative except for a residual distention of the palpebral vessels, which continued to improve, but was still present at the time of discharge on June 26, 1943. Vision was 20/20 in each eye, and the results of a fundus examination negative. Except for an occasional headache, the patient had no symptoms during convalescence.

#### SUMMARY

A case has been presented of a 20-year-old soldier who developed cavernous-

sinus thrombosis secondary to a pustule on the nose. Blood culture was positive for *Staphylococcus aureus haemolyticus*. During the first three days of hospitalization he received 5 gm. of sodium sulfadiazine intravenously and 36 gm. of sulfadiazine orally. After receiving the report on the blood culture sulfathiazole was substituted for sulfadiazine, and of this he received 116 gm. over a 16-day period.

The first signs of improvement appeared on the eighth day, 24 hours after an intravenous injection of 60,000 units of staphylococcus antitoxin. This was repeated with 40,000 units on the following day. The patient's condition, which had been critical up to this point, rapidly improved, so that at the time of discharge, on June 26, 1943, he showed only a mild residual distention of the palpebral vessels.

In view of the rapid improvement following the use of antitoxin one is tempted to attribute much of the good results to this therapy. Whether or not a favorable outcome would have been obtained if sulfonamides had not been used in conjunction with the antitoxin is uncertain. In such a critical condition one is prone to run the gamut of treatment and in so doing lose the ability to assess the value, individually, of the medications used.

*Station Hospital.*

#### BINASAL HEMIANOPIA

IRWIN E. GAYNON

LT. (MC), A.U.S.

Binasal hemianopia is that condition in which the nasal half of each field has no light perception. This type of field is rare, and is seldom of perfect bilateral division.

#### FREQUENCY

Von Graefe (1858) described one case which he considered to be due to the

bizarre effects of a bilateral lesion of the occipital lobes. Mooren (1867) recorded one case as the result of hysteria. Daae (1869) reported six cases associated with optic atrophy in the same family which was considered to be an abiotrophy. Knapp in 1873 reported one case which he attributed to pressure of the sclerosed carotids on the optic chiasm, in a case of generalized arteriosclerosis. Herschel (1883) reported one case with bilateral optic atrophy. He believed the patient to have had symmetrical hemorrhages in the occipital lobes. Henschen's case (1890) revealed a gumma surrounding the optic chiasma. In the same year Von Graefe wrote of a case caused by a gumma extending from the base of the brain to the optic foramen. Lang and Beavor (1894) cited a case due to tabes dorsalis in which the nasal defect was attributed to selective optic atrophy. Rakowicz (1895) reported one case with optic atrophy of unknown origin. Bull also reported a case in that year with optic atrophy. Fridenburg (1896) cites an instance in which binasal hemianopia occurred 18 months after a man had been struck on his head. Burnett (1900) reported a case following a fall on the head. Eskridge, Schmidt and Wegner, and Veasey (1897) each reported a case with papilledema due to brain tumor. Coppez (1911) considered his case to be due to thrombi in both occipital lobes following cardio-renal disease. Cushing and Walker (1912) cited a case in Leber's disease. They also found that 17 out of 300 patients with intracranial neoplasm showed hemianopic defects with a tendency toward binasal blindness and all followed a far-advanced consecutive optic atrophy. They also presented one case due to pressure of sclerosed carotids. Heed and Price (1914) described one case due to tabes dorsalis. Hartman (1933) found his case to be due to post-hemorrhagic blindness. Banduin (1934)

reported a case with acoustic neuroma of the cerebellopontine angle. Löwenstein (1935) reported a case with optic-nerve atrophy due to pressure of atheroma of the carotid arteries. Duncan (1936) presented two cases of intracranial tumor with optic atrophy (1) right cerebral hemisphere; (2) left frontal lobe; and one case of congenital lues with binasal hemianopia. Rouquier and Gaults's (1937) case was due to a probable arachnoiditis. Torkildsen's case (1938) was caused by a meningioma of the posterior cranial fossa.

### ETIOLOGY

From the data presented in the literature, the following etiologic factors have been collected: (1) The most common cause is distension of the third ventricle by intracranial tumor with resultant pressure upon the optic nerve by the circle of Willis. (2) The optic atrophy itself may be a cause. This may be considered under: (a) tabes dorsalis, and quoting from Fuchs "We must assume that the tabetic degeneration, as a rule seated in the optic nerve may locate itself farther back in the chiasma;" (b) idiopathy; (c) Leber's disease; (d) trauma; (3) syphilis; (4) pressure on the lateral fibers of the chiasma by thickened arteriosclerotic internal carotids; (5) hysteria.

It might be noted that the lesions, ascribed to a central origin, were not studied *post mortem*.

### CASE REPORT

R. F., a white boy, aged 13 years was first seen at the Children's Hospital (Chicago) on May 9, 1934, suffering from an acute right mastoiditis and a *Streptococcus viridans* septicemia. Ocular examination at this time was considered negative. A simple mastoidectomy was performed on May 19, 1934; the patient developed a lateral-sinus thrombosis on May 23, 1934.



The jugular vein was ligated and the clot removed. The postoperative course was extremely septic, with recovery two months from onset. A bilateral optic atrophy was discovered on June 18, 1935, while the patient was being treated in the endocrine clinic for obesity and a probable Lawrence-Moon-Biedl syndrome. X-ray report of skull on July 23, 1935, showed no evidence of brain disease but a slightly larger than normal sella. On August 7, 1935, a divergent

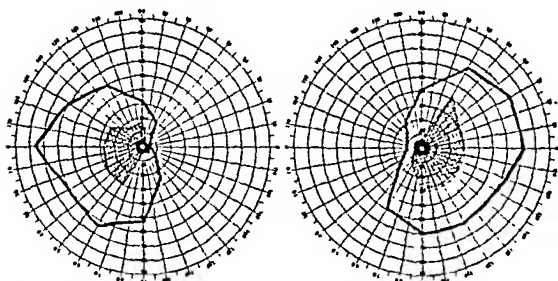


Fig. 1 (Gaynon). Visual field, showing the field for red cross-hatched.

strabismus was first noticed. All laboratory tests on spinal fluid and blood reacted negatively. Vision had been stationary for the past four years: O.D., 20/100; O.S., 20/200, with correction.

The father had died of nephritis at the age of 42 years; the mother had syphilis.

The patient was again examined on September 24, 1941, when the present defect was discovered. Physical examination revealed an intelligent, fairly obese youth of 13 years, whose only complaint was poor vision. Positive findings were mastoid scar, scar over right jugular vein, and tonsillectomy.

Ocular examination. Vision O.D., was 16/200, corrected to 20/200; O.S., 20/70+1, unimproved by correction.

Refraction. Vision O.D. with a +0.50D. sph.  $\approx$  1.00D. cyl. ax. 90° was 20/100; O.S. with a +1.00D. sph.  $\approx$  0.75D. cyl. ax. 90° was 20/70.

Both lids were normal. The conjunctiva was slightly injected, the anterior

chamber of normal depth. The irides were blue, the pupils equal, reacting to light and accommodation and consensually. The optic discs were round, not elevated, pale white in color; their margins fairly distinct; the cribriform markings were not seen. The retinal vessels appeared to be normal. The macula seemed to be elevated. Tension (Schiotz) was O.D. 19 mm. Hg; O.S. 19 mm. Hg.

Blood tests showed: Wassermann reaction, negative; red blood cells, 5,440,000; white blood cells, 6,400; hemoglobin, 13.2 mg. Polymorphonuclear cells, 40; eosinophiles, 3; lymphocytes, 49; monocytes, 8.

On October 6, 1941, the spinal fluid was clear, the pressure 200 mm.; the cell count, negative; Pandy test, 0; protein, 13.6 mg.; the Wassermann reaction, negative.

#### GLUCOSE TOLERANCE TEST 100 mg. glucose given.

<i>Fasting</i>	<i>Blood</i>	<i>Urine</i>
	108	0
0.5 hr.	145	trace
1 hr.	135	0
2 hr.	139	0
3 hr.	135	0

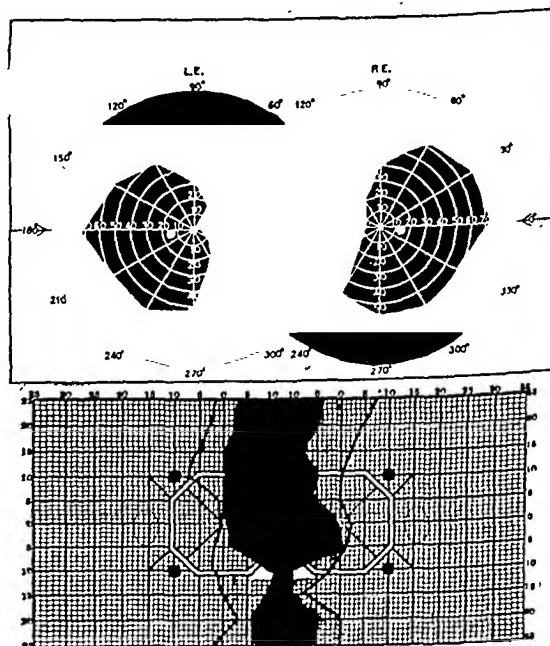


Fig. 2

The X-ray report, stated, as of October 4, 1941: "The stereoscopic X-ray examination of the skull of R. F. shows the sella to be shallow, but the clinoids and its floor are smooth. No abnormal calcifications are seen. The cranial bones and brain areas appear negative.

Ventriculogram reveals an atrophy at the chiasma. Hence, the lesion is due to a probable old healed arachnoiditis."

Visual fields are seen in figures 1 and 2.

#### SUMMARY

A brief review of the literature is given. An additional case is presented, due to a probable arachnoiditis at the chiasma.

### ANTERIOR-CHAMBER IRRIGATION WITH SULFADIAZINE

JOSEPH LAVAL, M.D.  
*New York*

The publication of the successful use of sulfanilamide in the anterior segment of the globe by Igersheimer (this Journal, 1943, v. 26, p. 1045) prompted me to report the following case.

Mrs. R. S., aged 60 years, a housewife, was admitted to the Mt. Sinai Hospital on September 10, 1943, for a cataract extraction following a preliminary iridectomy that had been performed in July. She was extremely myopic and mildly diabetic.

On the operating table an unusual complication arose. The episcleral-limbal suture which I use had been put in place, and the Graefe section had been performed, when suddenly the patient vomited. Before the speculum could be removed a good deal of the vomitus entered the cul-de-sac of the eye undergoing operation. The suture was drawn snugly and the lids were closed until the patient had freed herself of the gastric contents. Then the field was again prepared

sterile and the eyelids opened. The vomited material was flushed from the cul-de-sac with saline solution.

It is considered that the gastric contents are sterile in the absence of achlorhydria but I was fearful of a possible infection even though I had good reason to know that the patient had a normal gastric acidity. Accordingly, a vial of 25-percent sodium sulfadiazine for intravenous use was opened and diluted with physiologic saline to 10-percent strength. A small 2-c.c. hypodermic syringe was filled with the 10-percent sodium sulfadiazine and a hypodermic needle was attached. The needle was inserted into the anterior chamber and the latter was irrigated. The irrigation was repeated twice and then the cul-de-sac was flushed thoroughly with more of the 10-percent sodium sulfadiazine. Following this the cataract extraction was performed without any further complications. The patient was given 15 grains of sulfadiazine by mouth five times daily for the first two postoperative days. Healing and convalescence were entirely uneventful. There was no undue reaction at any time.

Apparently the anterior segment of the globe can well tolerate 10-percent sodium sulfadiazine, and irrigation with this chemical is nonirritating. Whether it prevented an infection in this case is questionable, but the point is that the use of a 10-percent solution of sodium sulfadiazine is safe and entirely innocuous.

*136 East Sixty-fourth Street.*

### EYES FROM AUTOPSIES\*

SAMUEL GARTNER, M.D.,  
VIRGINIA LUBKIN, M.D.  
*New York*

We have been fortunate in obtaining permission for a great many autopsies

\*From the ophthalmologic service of Montefiore Hospital.

which enabled us to remove the eyes. Most of them are removed through the conventional method of placing a speculum between the lids and enucleating the globe. If the autopsy includes the

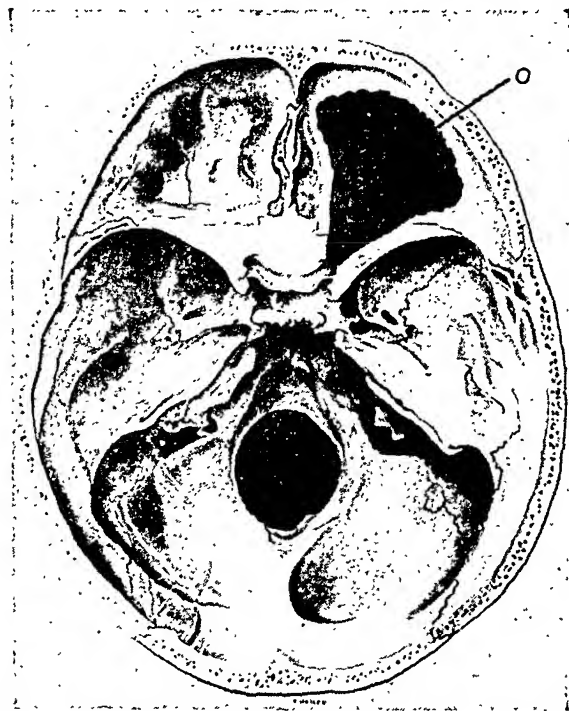


Fig. 1 (Gartner and Lubkin). Top view of base of skull. O, roof of orbit, which is removed.

brain, we have found it preferable to remove the eyes by the transcranial route, following the method Lambert<sup>1</sup> used. Figure 1 shows the roof of the orbit that is chiseled off, and through it the eye and the orbital contents are removed as one mass. The entire block of tissue is fixed and sectioned. Large slides are made that show the eye with a long section of optic nerve, the extraocular muscles *in situ*, and orbital vessels and nerves in their normal relationship, as in figure 2.

Great care must be taken to make the bodies presentable for burial, so glass eyes which match the original ones are placed in the sockets. Occasional embar-

rassment has been caused when the glass eye slipped out of position.

The following technique was developed to prevent such accidents. After enucleation, a wad of cotton, soaked in formalin, is inserted in the orbit to occupy the space of the globe. This hardens the tissues and forms a good support for the prosthesis. The glass eye is inserted and sutured into position so that it cannot move. The lids are closed, and then a large piece of cotton, saturated with formalin, is applied against the closed lids for a few minutes. The lids become quite rigid, so that they stay closed, and can be opened only to a small extent. A concealed intermarginal suture is occasionally used as an additional precaution.

In one method of attaching the sutures to the glass eye, holes were bored near the nasal and temporal ends with a dental drill. Once they were so prepared, they were satisfactory. However, we broke several eyes while drilling, and found the process tedious.

The method we now use is to apply the middle of a double-arm suture to the nasal and another to the temporal ends of the glass eye and fasten them in place.

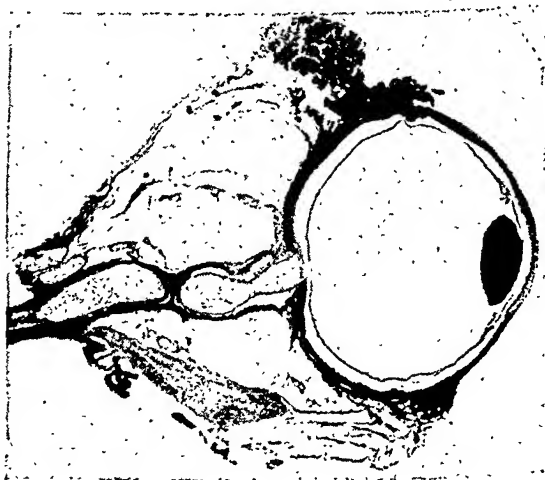


Fig. 2 (Gartner and Lubkin). Section of eye and orbital contents.

with Canada balsam. There are other adhesive substances which would do as well, provided they were not soluble in water and not affected by formalin.

A large curved needle is threaded on each end of the suture and carried through the tissues at the inner and outer canthus and tied inside the lids. This holds the eye securely and makes a very satisfactory appearance.

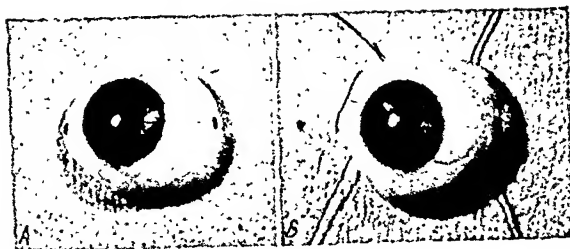


Fig. 3 (Gartner and Lubkin). Glass eyes prepared for autopsies. A, suture holes drilled in sides of eyes. B, sutures fastened to eye with Canada balsam.

#### REFERENCE

- <sup>1</sup>Lambert, R. K. Significant structural features of the ocular circulation. Jour. Amer. Med. Assoc., 1940, v. 114, p. 1802.

#### REFRACTION CLINIC\*

DISCUSSION BY DR. ALBERT E. SLOANE†  
Boston

A white woman, 55 years of age, became aware of poor vision in the right eye five months ago. She was told that she had retinal hemorrhages. Yesterday she was seen by another doctor who reported that both eyes show no evidence of pathologic change and advised that her refraction be tested. The patient complained primarily of ocular discomfort and blurred vision, especially when reading, following the onset of the "hemorrhages." Her present glasses are one year old and check to within 0.25D. of the findings as follows: She was wearing, right eye +4.25D. sph.  $\approx$  - .50D. cyl. ax. 90°; left eye +4.50D. sph. add +2.25D. sph.

#### EXAMINATION

Examination revealed: vision O.D. 20/200; with a +4.50D. sph.  $\approx$  - .50D. cyl. ax. 90° it was 20/50 "slow" (patient notes metamorphopsia). O.S. 20/200;

\* From the House Officers' Teaching Clinic, Massachusetts Eye and Ear Infirmary.

† Director of Department of Refraction.

with a +4.50D. sph. it was 20/20, add +2.50D. sph. for reading Well's no. 1. Pinhole disc over the right eye eliminated metamorphopsia but did not improve vision above 20/50.

*Induced phoria.* Vertical orthophoria. Distance 3<sup>Δ</sup> esophoria; near 2<sup>Δ</sup> exophoria. O.D. was the dominant eye.

During the examination this feature was noted: The vision was much better subjectively when the right eye was occluded, but immediately became uncomfortable and less clear when both eyes were open. Similarly, with the near glass, the patient had no difficulty reading Well's no. 1 type (fine Bible print), whereas with both eyes open the same type was barely legible and not comfortably so.

#### DISCUSSION

The symptoms usually can be explained in two ways. First, a problem in refraction, or, secondly, a problem in binocularity. In the first instance refraction can immediately be eliminated as the cause of her symptoms since the findings do not essentially differ from the glasses worn. The problem of binocularity may be fur-

ther subdivided as (1) a disturbing heterophoria; (2) aniseikonia. Examination revealed 3D. of esophoria for distance, 2D. of exophoria at near, which is well within normal limits and very likely does not in any way contribute to the symptoms.

The problem of aniseikonia is not so easily dismissed. This could not be the usual type of aniseikonia because, if it were, the symptoms would be present for a long time. the refractive errors might be expected to vary in both eyes, and vision would more likely be somewhat similar in the two eyes.

The patient read 20/50 "slowly." This indicates that 20/50 vision was possible through studying the letters and probably also that 20/70, while legible, was probably read hesitatingly and "slowly." The fact that metamorphopsia was also present suggests an explanation of the acquired aniseikonia. Metamorphopsia, when present in regard to letters, usually indicates an irregularity in the plane of the retina in the macular area, so that one is getting a distorted image that is comparable to the distorting effect of an irregularity in the surface of a mirror. The pinhole, by obstructing some of this area and thus removing interference, tends to diminish the distortion of letters. But the fact that vision does not come up to normal indicates that there is not only an irregularity of the surface, but also, that there is some damage to the retina. In this way one understands that an aniseikonia of an irregular type has been produced which is, in turn, producing binocular discomfort. This is particularly distressing to the patient for two reasons. First, a well-developed fusion sense does allow easy suspension of vision in this eye, and, secondly, the affected eye is her dominant eye. Thus, she is more disturbed than if it were the nondominant

eye that was affected. This may be compared to the embarrassment of a right-handed person who is suddenly required to use his left hand for precise work.

Therefore, the visual examination suggested some retinal pathologic change. It was found that the macular area showed an absence of the reflex and a peculiar marking of many irregular, small, yellowish areas which ordinarily are included under the general head of macular degeneration.

### DIAGNOSIS

Macular changes, retina, right eye, producing metamorphopsia with binocular discomfort.

### SOLUTION

All of these cases eventually are freed of symptoms through either of, or the combination of, two mechanisms: (1) the development of a compensatory suspension in the affected eye, removing the interference to binocular vision from its distorted image; (2) a diminution in the amount of metamorphopsia as the pathologic process resolves.

### TREATMENT

Explain to the patient the cause of his discomfort. He may occlude the affected eye when reading (usually with the hand), since it is usually during reading that symptoms are really distressing; for the metamorphopsia is disturbing in precise imaging but is not noticeable when looking at gross objects.

### QUESTIONS

House Officer: How did you determine that the right eye was the dominant eye?

Dr. Sloane: There are many tests. The one I used in this case was to have the patient make a circle with the first finger and thumb of both hands. The person then sighted the muscle light through this

circle. Then, by noting which eye was looking through the circle, the dominant eye was determined.

H. O.: Would the 20/50 vision, O.D., without the metamorphopsia give interference to the O.S. with its 20/20 vision so as to produce symptoms?

Dr. S.: Yes, the difference in visual acuity in two eyes which have so recently seen equally will tend to produce symptoms, and the metamorphopsia seems to cause more disturbing symptoms particularly at near.

243 Charles Street.

## SOCIETY PROCEEDINGS

EDITED BY DR. DONALD J. LYLE

### COLLEGE OF PHYSICIANS OF PHILADELPHIA

#### SECTION ON OPHTHALMOLOGY

December 17, 1942

DR. ALFRED COWAN, *chairman*

EDWARD JACKSON, FOUNDER OF THE SECTION

DR. BURTON CHANCE delivered a memoir on this subject which was published in this Journal (January, 1943).

MEMOIR OF LUTHER C. PETER, M.D.

DR. EDMUND B. SPAETH presented this tribute, which will be published elsewhere.

MEMOIR OF WILLIAM T. SHOEMAKER, M.D.

DR. WILLIAM ZENTMAYER presented a paper on this subject which will be published elsewhere.

#### LIPAEMIA RETINALIS

DR. M. LUTHER KAUFFMAN presented two cases of lipaemia retinalis, both showing interesting and somewhat unusual findings. The first was not in a diabetic patient and was the third such case reported. This patient had suffered from chronic alcoholism for about two years, and also had had attacks of acute gastritis and vascular hypertension. In

the second case there were marked changes in the walls of the retinal vessels and severe retinosis complicating the diabetes.

Neither patient was in coma on admission. If any acidosis was present in either patient it was not revealed by the carbon-dioxide combining power of the blood or by the urinalysis; pH of the blood was not determined.

The reason for lipemia becoming visible in the retinal blood vessels naturally depended to some extent on the lipid content of the blood. Dr. Kaufmann suggested that another factor might be the size of the lipid particles, which become larger in the presence of chemical or electrolytic imbalance. The increase in the size of the particles would make the lipoids more easily visible through the vessel walls. The particles in an emulsion tend to coalesce and become larger in anything but the optimum medium for that emulsion.

*Discussion.* Dr. Eunice L. Stockwell reported a case of lipaemia retinalis seen several months ago. The patient was a 41-year-old man who was admitted to the hospital with a typical history of diabetes mellitus of four months' duration. He had had no insulin before his admission. Dr. Stockwell saw him on the day of his admission. His blood sugar was 301 and the blood cholesterol was 1,456; his carbon-dioxide volume was 60

percent. The fundus in each eye showed the typical picture of lipaemia retinalis, the veins being full, cream-colored in appearance, and white in the terminal branches. The arteries were flat and ribbonlike, and approached the veins in size and color.

The patient was placed on insulin that day and the following day the typical picture of lipaemia retinalis disappeared. Although the veins and arteries were still slightly pale and the blood cholesterol was 1,401, the vessels returned to normal color.

Dr. Alexander G. Fewell congratulated Dr. Kauffman for picking up a case of lipaemia retinalis in a nondiabetic. He said he had seen only two cases of lipaemia retinalis. He thought the condition was much more common than reported. The case reported by Dr. Stockwell was a typical case of lipaemia retinalis, but the retinal picture entirely disappeared within 48 hours.

Very little had been added to Heyl's original ophthalmologic observation in 1886. With two exceptions, all previously reported cases had been in diabetics. One exception was the case reported by Wagner in 1922. The patient was a nine-year-old boy who had undergone radium treatment for leukemia. The other was that of a poorly nourished child, aged one year, with an associated xanthomatosis and enlargement of the spleen. In nearly all of the reported cases there had been an associated acidosis, and, in quite a number, xanthomatosis. The acidosis in these cases was usually severe and of short duration, but it might extend over a long period of time and be comparatively mild, as reported in McKee's last case. In only a few instances had there been a careful chemical analysis of the blood with studies of the various blood lipoids. In general terms, it might be stated that lipaemia retinalis appeared when the value of the blood fat rose above 3.5 percent and disappeared when

it fell below 2.5 percent.

It had been suggested before that lipaemia retinalis was due to some condition other than the total amount of fat in the blood. This must be true, for a number of cases had been reported in which the fat content of the blood was high but no lipaemia retinalis was present. Before the discovery of insulin, practically all diabetic patients who developed lipaemia retinalis died in diabetic coma, but now with insulin these patients might live for many years.

Dr. I. S. Tassman asked Dr. Kauffman if he knew of any relationship between lipaemia retinalis and the white-cell count in these cases, especially since one case was reported by Wagner as occurring in leukemia. This brought up the question of whether the white count might have some relationship to the occurrence of lipaemia retinalis.

The other condition, such as xanthomatosis, was understandable because most of such cases were associated with diabetes; particularly those that occurred in young children in the form of the Schüller-Christian disease, which was a disease of the lipid metabolism.

Dr. M. Luther Kauffman, in closing, thanked the discussers for their contributions. Concerning acidosis he pointed out that even though the urine and all other findings were normal, the chemists showed that it was impossible to say an acidosis did not exist unless pH determination of the blood was made. This was called an uncompensated acidosis.

As Dr. A. Fewell pointed out, these cases might be much more common than the literature indicated. The way to discover them was to examine ophthalmologically everybody admitted to the medical service of the hospital. The ratio of phospholipins to total fat was a point to be considered in causing lipemia to become visible in the retinal vessels. It might also have an effect on the electrolytic balance. The chemists pointed out



that any change in the electrolytic balance would have a tendency to make these fat particles coalesce.

His male patient had a leukocyte count below 9,000 at all times. The girl's count ranged from 8,000 to 16,000 but she had had frequent infections. He did not believe that the leukocyte count was a factor in lipemia.

#### AN UNUSUAL CASE OF BIRTH INJURY OF THE EYE

DR. F. H. ADLER and DR. E. GERARD SMITH presented the case of a 33-year-old physician who had sustained a birth injury, which was evident today by a large depression over the left frontal arc. He was refracted in 1931 and the findings were as follows: R.E.  $-2.50D.$  sph.  $\ominus -0.50D.$  cyl. ax.  $60^\circ$ , vision 20/20; L.E.  $-3.50D.$  sph.  $\ominus -2.25D.$  cyl. ax.  $180^\circ$ , vision 20/20. In 1935 the refractive error was R.E.  $-2.50D.$  sph.  $\ominus -0.75D.$  cyl. ax.  $50^\circ$ ; L.E.  $-2.75D.$  sph.  $\ominus -2.75D.$  cyl. ax.  $165^\circ$ . The vision was 20/20 in each eye.

On reëxamination in 1938 the right eye was found to be about the same and the left had changed to  $-1.00D.$  sph.  $\ominus -2.75D.$  cyl. ax.  $166^\circ$ . Four years later the right eye showed little change but the left eye was now  $-3.25D.$  cyl. ax.  $166^\circ$ . When last examined in 1942 the right eye again showed very little change. The left eye was found to be  $+2.25D.$  sph.  $\ominus -3.50D.$  cyl. ax.  $170^\circ$ . This represented, over a period of 10 years, a total change of 5.75 diopters. The vision was still 20/20 in the left eye after each refraction.

Examination of the eyes showed a left hypertropia with fixation with the left eye. The right eye turned down and in, the patient suppressing the vision in the right eye. Due to facial asymmetry the left eye was 5 mm. higher than the right. The rotations of both eyes were full in all directions except on the left, where there was some limitation of outward

movement. The right fissure was slightly wider than the left. The tension was 20 mm. Hg (Schiötz) in the right eye and 0 mm. Hg in the left eye.

Slitlamp examination of the right eye showed a few pigmented and nonpigmented deposits on the endothelium, but was otherwise negative. Examination of the left eye showed a marked chemosis of the conjunctiva of the whole lower cul-de-sac, limited to the lower bulbar conjunctiva. There were no signs of inflammation. There was a considerable amount of pigment on the anterior lens capsule, probably congenital in origin.

Ophthalmoscopic examination of the fundus of the right was negative. The fundus of the left eye showed slightly indefinite margins at the upper and lower poles of the disc. The retina showed some reflexes which were suggestive of retinal folds which may be due to an old retinal detachment.

Dr. Smith believed that the picture had a rational explanation. The globe might have been ruptured at birth. This rupture probably healed but may have left a fistula through which aqueous was escaping into the subconjunctiva and retro-retinal spaces, which would account for the chemosis of the conjunctiva and possibly a forward displacement of the retina. The latter was suggested by the change in refraction.

Dr. F. H. Adler said he was sure that Dr. Smith, and he, and their very obliging patient, would welcome any suggestion that anyone might have that would differ from this explanation. He had not been able to find in the literature a case that duplicated this, and the only possible explanation that had occurred to them was what Dr. Smith had given. The patient's tension was zero with the tonometer. Dr. Adler had always taught his students, and had read in the literature, that a tension of approximately 25 mm. Hg (Schiötz) was necessary for the maintenance of the optical properties of

the eye. This eye had a visual acuity of 6/6 in spite of zero tension.

*Discussion.* Dr. James S. Shipman asked Dr. Smith if he had a record of what his patient's tension was at first refraction.

Dr. H. Maxwell Langdon asked if it was not remarkable that this case remained quiescent for a number of years. As he understood it, about 10 years ago the eye began to develop peculiarities and the patient was now 34 years old. What had happened which produced this peculiar series of changes in the course of events? Did anything happen that could have caused an opening up of a fistula? He was not suggesting that there was a fistula there, but he just wondered what caused the drainage to start. Could it have been that the pressure on the globe in taking the finger tension caused the leakage of aqueous which apparently was taking place?

Dr. Alfred Cowan thought it did seem remarkable that this condition had progressed as described. Did not that seem unusual for an ordinary birth injury? In his experiences, birth injuries cleared up to a remarkable degree. It seemed from the appearance of the conditions which were considered to be due to birth injuries, that the eyes recovered to a much greater extent than if the same injury were sustained by an older person. So this case, if it really was a birth injury, was unusual in that it had become progressively worse.

Dr. Smith answered in regard to Dr. Shipman's question concerning what the tension was, that he got in touch with the men who examined the patient previously, and they told him his tension was normal when they examined him. With regard to Dr. Langdon's question about any injury, as far as he knew there was no subsequent injury. The patient did believe, however, that the chemosis below the cornea had always been present, to a greater or less degree.

## PURTSCHER'S ANGIOPATHY TRAUMATICA RETINAE

DR. EDMUND B. SPAETH presented two cases of Purtscher's disease, one in abstract, the other in detail as to its clinical course.

The literature relative to this condition was discussed, for the etiology of the angiopathy is still not at all satisfactorily answered. This was reviewed in an attempt to determine, if possible, a consensus which might answer that question. The author himself suggested that fat embolism must be seriously considered as the possible cause of the retinal changes.

*Discussion.* Dr. James S. Shipman commented that this condition was not a recent discovery, having been described by Purtscher in 1910 in the case of a head injury. Even earlier than that, in 1900, Neck noted these fundus changes after compression or crush injuries of the chest. However, most of the literature on the subject was of European origin, and only in the past several years had it engaged the interest of American ophthalmologists. In a paper read before the American Ophthalmological Society and reported in the Archives of Ophthalmology in 1939, Bedell reviewed the literature; he had found 40 cases, and to these added 3 of his own.

In addition to the term "Purtscher's disease," the condition was also called "traumatic retinal angiopathy," "lymphorrhagia retinae," and most recently, "retinal teletraumatism." Knapp's "Medical ophthalmology," published in 1918, contained a description of the ophthalmoscopic picture, although it was given no definite name at that time. More modern textbooks included it under one of the above headings.

The usual history was a rather marked loss of vision in one or both eyes following a head injury, a compression injury of the chest or abdomen, or fractures of the vertebrae. The onset oc-

curred either immediately following the accident or the vision failed within a few days.

Externally there might be subconjunctival hemorrhages, often small, and ecchymosis of the eyelids and face as well as discoloration of the neck, chest, and upper extremities. There was no evidence of direct injury to the eye, such as laceration, nor was there any history of such injury.

Ophthalmoscopic examination revealed fairly typical fundus changes. Essentially, these were hemorrhages, exudates and edema, and dilatation of the retinal veins with constriction of the arteries. There might also be pallor of the disc, but more often this developed later when, in some cases, secondary optic atrophy ensued. A white appearance of the macular region had also been recorded as a late finding.

The hemorrhages might be small or massive, usually the latter. They might be flame-shaped or round. Most often they were found in the superficial layers of the retina, but a number of vitreous hemorrhages had been recorded. Stokes described a case in which there was such a massive hemorrhage in the macula that it had the appearance of "an island in a lake of blood." In addition, there was in *this case a round hemorrhage in the fovea*.

The edema and the exudates might be described together, these terms being ill defined by the various authors and in some instances, as in Bedell's paper, were used interchangeably. This was best shown by descriptions such as "the entire posterior pole was an immense milky white swelling covering the disc and retinal vessels" (Bedell); "a white, cloud-like plaque near the disc" (Bedell); "many discrete, elevated, whitish areas with round edges, some confluent, resembling cotton wool, and found along the superior and inferior temporal vessels" (Stokes). There might also be, as in the case presented by J. W. Smith, "a

diffuse dense cloud or veil in the posterior vitreous" which entirely obscured the fundus and which was considered secondary to the retinal pathology.

The changes in the caliber of the blood vessels, that is, the constriction of the arteries and dilatation of the veins, was similar to that seen in thrombosis of the central retinal vein. It might be added here that the exudates were often found along the course of the vessels; hemorrhages, when small, were apt to be seen along the retinal veins.

The secondary optic atrophy was not a constant finding. A great many of the cases reported had been followed for only a short time. However, Bedell had the opportunity of seeing a case 15 years after he had made the diagnosis of traumatic retinal angiopathy. The disc in this instance was waxy pale, the vision markedly reduced as one would expect.

The mechanism of production of the hemorrhages and exudates was not entirely known. Purtscher's theory was that head injuries induced compression of the spine in its longitudinal axis, which, in turn, produced increased intracranial pressure. This pressure forced the spinal fluid through the intervaginal space into the nerve head and along the retinal vessels, extravasating into the retinal tissue through the ruptured perivascular lymph spaces. However, since the intervaginal space is not a true cavity, this was hard to accept. Friedenwald believed, as did Urbanek and Loewenstein, that the changes are due to fat emboli. If this was true, it would seem that more of these cases should be seen following fractures of the long bones. Experimentally, Willers trephined the skulls of rabbits and found that the brain could be made to bulge through the hole when pressure was applied to the thorax or abdomen. Each of these theories partially explained the pathologic physiology; no one of them completely explained it.

There had been only one case in which

histologic sections of the eye were made and microscopically examined. This was reported by Savitsky and Gross in December, 1935, before the New York Neurological Society. They found "round structures within the retinal layers, more in the superficial, which reacted to the stains for fat." There was a division of opinion as to the clinical diagnosis, several ophthalmologists considering retinitis albescens to be the true diagnosis rather than traumatic retinal angiopathy. For this reason it would seem unwise to accept the aforementioned pathologic picture as the usual one or as pathognomonic of the condition under discussion.

In none of the reports was any specific treatment suggested; treatment was not even mentioned. Presumably potassium iodide internally might be used to good effect.

The prognosis in these cases was variable. In a number of them there had been a return to normal vision, despite rather extensive retinal hemorrhages, exudates, and edema. However, secondary optic atrophy was always a threat in severe cases, and in others there had been reported permanent damage in the macular region consisting of fine dots and scattered pigment.

Dr. Edmund B. Spaeth said he had uncovered 51 relevant references, and these included some 70 cases. In regard to fat emboli, and the question which Dr. Shipman raised, was it possible that these were more probably the result of crushing injuries rather than otherwise? Injuries to the pelvis were not uncommonly followed by emboli and distant infarcts.

He did not believe that the histologic report mentioned was one of angiopathy traumatica retinae, and, with Dr. Shipman, he declined to accept that report as one for this condition.

Warren S. Reese,  
Secretary.

## NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

December 7, 1942

DR. ISADORE GIVNER, *presiding*

### SYMPOSIUM ON TROPICAL OPHTHALMOLOGY

#### THE INCIDENCE OF OCULAR DISEASES IN THE TROPICS

DR. BERNARD KRONENBERG spoke of the ocular diseases in the tropics, and tropical diseases which have ocular symptoms. He stated that tropical ophthalmology is interesting because of the wealth of material resulting from poverty, neglect, ignorance, and lack of medical attention. Special climatic and dietary factors were discussed. Brilliant light, wind, and dust cause a large number of complaints.

Actually there are very few ocular diseases to be found only in the tropics. Among these are loa loa, microfilaria, and onchocerciasis. Not all diseases are found in all geographic areas of the tropics. Some are limited to the African or Caribbean regions, and others to the Asiatic regions. Trachoma and vernal catarrh, although found in some of the tropics are not seen in Puerto Rico.

The diseases which have ocular symptoms are divided into three groups: (1) Those found only in the tropics; (2) those found primarily in the tropics but also in other areas of the world; and (3) diseases which occur in all areas but which are rather frequent in the tropics.

Under the first group he mentioned yaws, trypanosomiasis, and yellow fever. In the second group he mentioned dengue, relapsing fever, Weil's disease, leprosy, malaria, and intestinal parasites. Malaria was discussed in detail and attention was drawn to the necessity of differentiating between amblyopia due to quinine and

malarial optic neuritis. In the third group of diseases he discussed cholera, dysentery, and typhus. Another group discussed was vitamin deficiencies.

Common ocular diseases of the colder climatic areas also occur in the tropics. He pointed out that uveal diseases and cataracts were more common in the tropics. Congenital cataracts were seen more frequently on smaller islands where there was much intermarriage. Refractive errors show nothing unusual except an early presbyopia.

Preoperative care must pay special attention to dietary deficiencies and the common occurrence of syphilis and poor dental conditions. The postoperative care, because of the heat and humidity, must be a little different. Dressings must be changed more frequently.

In conclusion, he pointed out the definite existence of a field of tropical ophthalmology.

#### OCULAR ONCHOCERCIASIS

DR. EDWARD B. GRESSER said that onchocerciasis is an endemic roundworm infection found in widely separated tropic and subtropic foci, caused by the filaria of the genus *Onchocerca*, two species, *Onchocerca volvulus* and *caecutiens*, being parasitic for humans. The vector for human onchocerciasis is the biting black fly of the *Sulidae* family. The disease is of slow evolution, affects all ages, colors, sexes, and social stations, and is characterized by subcutaneous fibrous nodules or cysts located anywhere on the body and containing adult filaria. The mature filaria produce thousands of the markedly motile microfilaria which wander through superficial layers of the skin, accounting for the predisposition to ocular invasion with cysts above the neck line. Except when blindness occurs, the disease is neither debilitating nor disabling. The

blindness can be of any grade or extent, unilateral or bilateral.

The microfilaria invades every tissue and layer of the orbital contents. The living parasite produces mild reactions, but when dead and disintegrating, the reactions are marked. The process becomes intermittent and chronic with acute exacerbations. Photophobia, lacrimation, and discomfort are constant. Pain is hardly ever marked, circumcorneal injection is invariable, and a rather torpid kerato-iridocyclitis is the rule, although a keratitis or iritis may be present alone. With the slitlamp, the living parasite can be discerned in the bulbar conjunctiva, cornea, and anterior chamber.

Pigment granules are spread over the surface of the iris, and, collecting in the lower angle, form, with inflammatory products from the iritis, a partial brown ring and a mass which contracts and causes pupillary deformity. Synechiae with pupillary occlusion and seclusion, secondary cataract, and occasionally secondary glaucoma occur. There may also appear chorioretinitis with degeneration of the pigmentary epithelium and clumping of pigment without relation to the vessels. The corneal changes are remarkable: A superficial punctate keratitis of grayish dots, a fraction of a millimeter in diameter, is found in the deeper epithelium and the outer stromal layers and usually in the lateral parts of the cornea. This is transient or permanent and in protracted cases occurs in the deeper layers. The corneal epithelium in later stages is irregular from cell swelling, desquamation, and scarring. Fairly common is a limbal vascularization accompanied by connective-tissue sheaths and inflammatory cells anterior to and often replacing Bowman's membrane. Descemet's membrane frequently shows folds or dehiscences.

Accompanying the cyst formation and

ocular disease is a disseminated dermatitis characterized by induration with a greenish hue. This discoloration, noted in the western world but not in Africa, may be due to difference in skin pigmentation.

No cure is known for onchocerciasis. Chemotherapy has not proved effective in any form. Hyperthermia, of theoretical value, has not been used. Most of the success achieved has been through surgical removal of the cysts and adult worms, presenting production of the microfilaria, and in preventing reinfection.

*Discussion.* Dr. Harry Most said that despite the great emphasis between the type of disease occurring in the western hemisphere and Africa, it is doubtful whether there are two valid species of *Onchocerca*. The African and Mexican disease should be considered the same, caused by the same parasite.

The black fly, which is the vector, lays its eggs in water, sometimes at the bottom of streams. Eradication of these flies, breeding in fast-moving mountain streams, is such a difficult problem that most people in preventive medicine consider it hopeless. It resolves itself into educating people not to go to the streams to bathe in the daytime, and to keep covered, since this is a day-biting fly.

Treatment is not so hopeless as Dr. Gresser pointed out. For the most part it is impractical to remove the nodules from all patients. It has been shown that it is possible to inject the nodules with bichloride of mercury, hexylresorcinol, arsenicals, or gentian violet.

Dr. Gresser, in conclusion, replied that while the literature is replete with therapeutic procedures and promises of apparent cures, in the last analysis, nothing touches the adult filaria, whether by injection of the cyst or by intravenous administration of drugs.

#### EXPERIENCES IN AN EYE CLINIC IN THE CANAL ZONE

DR. G. G. MARSHALL told of his experiences while chief of the eye, ear, nose, and throat section of the Gorgas Hospital, commencing in November, 1917. He found that natives of the tropics became presbyopic at an earlier age than those of the temperate zone, but there was no greater frequency of cataracts, partly explainable by the relative youth of most of the patients seen. Pterygia were very frequent among the Negroes, and bilateral pterygia were not uncommon. Simple conjunctivitis, due to the tropical sun and dust in the dry season, was prevalent but not serious. Koch-Weeks infection was more severe and corneal ulcers were frequent. The population of the city of Panama was said to be 30 percent syphilitic, and extensive choroiditis and optic atrophy were very common. Careful exclusion of emigrant laborers with eye disease made trachoma very rare.

Night blindness was prone to develop in the malaria-infected Negro living on a deficient diet. These patients recovered in 10 to 20 days when given fresh milk, vegetables, and cod-liver oil. No cases of malaria came to Dr. Marshall's clinic for treatment as such.

Leishmaniasis has been found in Brazil and Panama and has various manifestations. In Central America it is characterized by ulcers of the nasal mucous membrane, from which the conjunctiva is infected, and then the cornea, causing severe keratitis. Plasticlike deposits are found on the cornea and perforating ulcers may result. There is ciliary congestion, pain, and photophobia.

Dr. Marshall visited a leper colony at Palo Seco and treated all stages of the disease. Facial-nerve paralysis, ptosis, and loss of brows and lashes were early symptoms. The iris and cornea are the least resistant parts of the eye. On the

iris are pearllike bodies containing the bacillus which may extend to occlude the pupil. The iris finally atrophies. Corneal involvement may be punctate, annular, or diffuse parenchymatous and may progress to blindness. The vitreous, choroid, retina, and optic nerve are involved late. Cataracts are frequent but extraction is of little value as by this time other conditions make the eye hopeless.

*Discussion.* Dr. Connor said that in a case of malaria developing amblyopia he prefers quinine to atabrine. He has never seen a case of blindness in which the patient remained blind from quinine; and even though the drug would be continued in small doses until he recovered, eventually the vision would return.

#### BIOMICROSCOPY IN TRACHOMA

DR. MILTON BERLINER said that the frequency of trachoma has so declined with the curtailment of immigration that the possibility of its presence may recede from the ophthalmologist's mind. While biomicroscopy has not made great contributions to the knowledge of trachoma, it has so correlated histologic changes with clinical findings as to permit early and differential diagnosis heretofore possible only by tissue examination.

Trachoma, like many other forms of chronic conjunctivitis, passes through the stages of hyperemia, neovascularization, papillary hypertrophy, and follicle formation. Neovascularization, following closely the hyperemia, is best seen in the tarsal conjunctiva at the beginning of inflammation or following prolonged mechanical irritation. Biomicroscopy shows small vascular tufts due to capillary proliferation from the normal vascular network just beneath the epithelium. The naked eye sees these as small red dots, easily mistaken for petechial hemorrhages, which may appear later. The organization

of the capillary tufts results in the formation of papillae which can be seen in outline upon vital staining with azur II, even before they cause surface excrescences. It is unknown whether some obscure chemotaxis or the firm attachment of the conjunctiva to the tarsus accounts for the appearance of these papillae in the tarsal rather than the bulbar conjunctiva. Follicles result from irritation causing lymphoid hyperplasia of the adenoidal layer of the tarsal conjunctiva. This reaction occurs in many viral, bacterial, and chemical conjunctivitis. Follicles and papillary hypertrophy may occur simultaneously and must be differentiated. The follicles are translucent protuberances between the papillae and are several times larger. There is a superficial vascular trellis-like network in contrast to the central vascular tuft in the papillae. Ordinarily follicles shrink and disappear in time, but in trachoma they are invaded by a fibroplastic process, forming scars. Ordinarily follicles are found in the lower lid and fornix, but in trachoma they are chiefly in the upper lid.

At the onset of trachoma, when only mild congestion is seen with the naked eye, biomicroscopy may reveal typical features. Cuénod and Nataf have presented an excellent analysis of trachoma. Even when only a pinkish conjunctival blush is seen grossly, with high magnification and optic section are found small reddish dots just beneath the epithelium which are distinguishable as the newly formed perpendicular vessels of the incipient papillae. At the same time the small, round, slightly protuberant pale follicles are beginning to appear. An infiltrative haze at the limbus and proliferation of the superficial limbal arcades are seen in the early stages of trachoma.

The velvety appearance of the conjunctiva is the most striking feature of the second stage. Each papilla appears to be



a tile of mosaiclike pattern which is differentiated from the papillary hypertrophy of benign conjunctivitis by the combination of papillae, follicles, and corneal involvement. Follicles may appear on the caruncle and semilunar fold. High magnification after vital staining with azur II exhibits bluish follicles and papillae outlined by dark-blue dots, the whole resembling a hexagonal mosaic.

Bleblike formations resembling small "sago-grains" occur, especially on the upper tarsal conjunctiva and caruncle. These result from proliferative epithelial downgrowth into the submucosa with the formation of pseudoglands.

Stage three commences with delicate white lines of scar tissue between the papillae, and cicatricial invasion between the absorbing ruptured or necrotic follicles producing stellate scars first visible under the biomicroscope.

In the fourth stage the increased scar tissue results in a smooth, avascular white surface. A horizontal white band, the superficial line of Arlt, develops in the middle of the tarsus. Contraction of the scar tissue leads to the dire sequelae which are due mainly to deformity of the eyelid or dryness of the eye following destruction of the secretory elements. Further, the accompanying pannus leads to loss of vision.

Biomicroscopic study shows pannus to be an early specific part of the disease, not a complication. Almost immediately after the onset there is an alteration of the limbal reluctance and vascularization which may be overlooked by ordinary methods of examination. Newly formed capillary loops extend in Bowman's zone. At this level many grayish points and lines produce a delicate haze. Within this area may appear small follicles, which, when, surrounded by a capillary network, form Herbert's rosettes. Follicles may be abortive or develop fully and then empty

and organize, leaving small epithelialized depressions, usually near the limbus, known as Herbert's marginal pits. Irregular facets follow the breakdown of small subepithelial infiltrations. The capillary loops progress downward with a relatively horizontal border preceded by a grayish area of faint infiltration. At first the pannus is superficial, but in severe cases there is destruction of Bowman's membrane with deep scarring and vascularization and irregular thinning of the entire cornea. Secondary degenerative changes, such as calcareous deposits, fatty hyaline degeneration, and keratectasia are found with pannus of long duration.

*Discussion.* Dr. L. A. Julianelle emphasized the stages of hyperemia, neovascularization, follicle formation, and papillary hypertrophy as merely the result of a prolonged low-grade stimulus. Consequently the diagnosis of trachoma before pannus or scar formation is difficult.

The cause of trachoma is a virus, although it differs in incubation period, course, and immunity from the usual virus diseases. The inclusion body, believed by Dr. Julianelle to be the virus, can be seen in scrapings from the upper tarsal conjunctiva, stained with Wright's stain, and permits early diagnosis. Most viruses have high tissue selectivity and, regardless of their mode of entering the body, invade a particular tissue. Trachoma, showing the greatest selectivity, enters the eye only by way of the eye and can affect only the epithelial cells of the anterior segment. When clinical signs or symptoms appear a full-blown case of virus infection is already present. This leaves two possibilities for treatment: to prevent the virus from entering the cell, and to kill it while it is in the cell. The latter is the basis for treating trachoma, and is difficult as it calls for an agent to enter the cell and kill the virus but not the cell itself. Trachoma burns out spontane-

ously, and scar tissue, which is not susceptible to the virus, is formed in the process. Curettage, silver nitrate, and copper induce scar formation. The sulfonamides have had success ranging from zero in Dr. Julianelle's hands to 100 percent in the Indian Service. He is not convinced that they are effective in trachoma.

Dr. E. Waldstein described his own personal case of trachoma to illustrate the possibility of an acute onset with profuse discharge. He had seen favorable reaction to sulfonamide medication, but admitted its concurrent use with other forms of treatment.

Dr. M. Jaffe asked whether incision of the conjunctiva at the limbus, then stripping it back and curretting the blood vessels to the pannus, resulted in increased transparency.

Dr. A. Braley stated that the Indian Service has found that practically all of its cases recover in a short time with sulfonamide therapy. Periodic scrapings show disappearance of the inclusion bodies while the patient is under treatment. In a series of over 200 patients at Fort Apache, 10 showed no improvement and approximately 10 others recurred. Treatment of another group led to the conclusion that without adequate or sufficiently prolonged administration of sulfonamide, good results cannot be expected. He had never seen a proved case of trachoma failing to respond to sulfanilamide.

Dr. G. Epstein asked whether there can be trachoma without pannus.

Dr. Berliner, in closing, said he had not seen spectacular results with the sulfa group. He had not performed peritomy with curettage but had transplanted mucous membrane at the limbus and also inserted catgut subconjunctivally and found little reaction in the conjunctiva at the limbus; there was some clearing of the superficial scars but not the deeper

ones. He said he has never seen trachoma without pannus.

Leon H. Ehrlich,  
*Secretary.*

## CHICAGO OPHTHALMOLOGICAL SOCIETY

December 21, 1942

DR. LOUIS G. HOFFMAN, *president*

### SCIENTIFIC PROGRAM

#### THE STRUCTURE AND FUNCTION OF THE RETINA

DR. STEPHEN POLYAK (by invitation) presented a paper on this subject.

*Discussion.* Dr. S. Gifford and Dr. H. J. Smith discussed this paper.

#### KODACHROME CLINIC

DR. ROBERT VON DER HEYDT chose the following subjects for this presentation: 1. choroiditis; 2. rare clinical conditions; and 3. ocular trauma.

### CLINICAL PROGRAM

(Presented by the Department of  
Ophthalmology, University of  
Chicago)

#### AVASCULAR INTERSTITIAL KERATITIS— QUESTIONABLE

DR. LOUIS ALKOFF presented R. B., a white boy, who was under treatment for congenital syphilis. He was brought to the Out-Patient Department on May 6, 1942, because of clouding of the cornea of the right eye. On examination, the vision could not be tested, but he could see people and objects at a distance. A faint circumcorneal flush was present in the right eye. The cornea showed a dense, deep, wedge-shaped opacity, with the base from the 7- to the 11-o'clock position. The cornea of the left eye showed a fainter similar opacity. Slitlamp examination re-

vealed edema of the posterior stroma with roughening of the anterior and posterior epithelial surfaces. There were no vessels.

During the next two weeks the left eye became as clouded as the right and the patient began to stumble. He was admitted to the hospital and given 10 injections of typhoid vaccine. The opacities began to shrink and become fainter until they just covered the vertex of the cornea in each eye. No vessels were present; the opacity was still in the deep stroma with roughening of the anterior and posterior surfaces.

RETINITIS PROLIFERANS, VITREOUS HEMORRHAGE, RETE MIRABILE OF THE RIGHT EYE; PERIPHERAL RETINAL HEMORRHAGE AND EXUDATE OF THE LEFT EYE

DR LOUIS ALKOFF said that C. K., a 42-year-old man, was first seen in October, 1942. The patient stated that two years ago he had suddenly seen black streaks before the right eye and his vision decreased immediately. He further stated that the vision in this eye had been 20/20 prior to that time. He was treated with O.T. injections for four weeks and the vision slowly improved. Since then he has had four similar episodes. There was also a history of sudden collapse of the right lung, for which he was treated with bed rest for nine months.

Vision, on admission, was R.E. 20/200, L.E. 20/13+1. The vitreous in the right eye showed many floaters, and the disc could hardly be seen. A dense white band of vascularized proliferating retinitis could be seen extending from the disc at the 2-o'clock position toward the temporal portion of the retina and vitreous. The macula was not seen. The fundus of the left eye was normal except for several small granular hemorrhages and irregular white exudative lesions, 6 disc diameters out in the periphery, at the 1-o'clock position. These were situated at the terminal

branches of the superior temporal artery.

Laboratory examinations showed no findings of significance. The patient was to be tested for brucellosis, since several members of his family have had it, and it is endemic in his community.

SYMPATHETIC OPHTHALMIA

DR. MAURICE DRELL said that J. O., a 64-year-old man who had been presented before the Society last year, had sustained an injury to the right eye in 1916, at which time a foreign body was removed. There had been recurrent pain and redness in the eye with general decrease in vision to perception of hand movements only at the time of the initial examination in July, 1941. Examination showed an iridocyclitis, complicated cataract, and an old scleral wound of the right eye. The left eye was clear.

Treatment consisted of the application of heat, atropine, and proteolac, but no marked change occurred until September 18, 1941, when he complained of pain in the left eye of five days' duration. The left eye showed an increased ray in the anterior chamber with cells, and engorged iris vessels. The left vision decreased from 20/20 to 20/50. The following day the symptoms had become more marked, and the pupil of the left eye had not dilated at all with atropine. The right eye was enucleated that day. On section this eye showed a typical sympathetic ophthalmia.

Since that time the vision of the left eye has improved to 20/16 but the patient has had a chronic iridocyclitis and a number of exacerbations and remissions. He has been treated with, and become sensitive to, atropine, scopolamine, homatropine, and duboisine. He has had salicylates, one course of neoarsphenamine, three courses of mapharsen, and the pupil has been kept dilated with 10-percent neosynephrin. The vision, at this time,

was corrected to 20/25+2 and he was able to carry on his work as a bartender.

#### ORBITAL NEOPLASM

DR. MAURICE DRELL said that J. D., a 44-year-old man, was first seen in 1935, when he had an otherwise asymptomatic exophthalmos of the right eye. Exophthalmometer readings were R.E. 23 mm., and L.E. 14 mm. There was some limitation of abduction and adduction of the right eye. The fundus and visual-field studies were negative. The chemistries, serologies, and urinalyses were negative; X-ray studies of the skull, orbits, optic foramina, and sinuses were also negative. The patient was seen by the Neurology Clinic, and a diagnosis of orbital tumor was made. Transfrontal exploration of the right orbit was performed but no lesion was found.

The patient returned in November, 1942, with an increase of protrusion of the right eye, and occasional redness after imbibition of alcohol. Exophthalmometer readings were R.E. 26 mm., and L.E. 15 mm. A mass was palpable below the superior nasal orbital margin; there was limitation of movement in all directions, especially superonasally; and some conjunctival congestion was present. Vision, with correction, was R.E. 20/200; L.E. 20/20. The fundus of the right eye showed some papilledema. The visual field studies showed enlargement of the blind spot and constriction of the lower temporal field of the right eye. X-ray studies showed what appeared to be a generalized decalcification of the posterior orbital wall, which was interpreted by the roentgenologist as secondary to the orbital neoplasm. An attempt was made at air injection of the orbit for further X-ray visualization, but upon insertion of the needle into the orbit, extravasation took place into the syringe, which suggested perhaps a vascular neoplasm. Further

local procedures were postponed until the extravasation should have become completely absorbed.

#### DIABETIC RETINOPATHY; BILATERAL RETE MIRABILE

DR. NORMAN TEPPER said that L. W., a 52-year-old woman, came to the clinic four months ago. Four days previously she had noticed a sudden decrease in the acuity of her vision, everything beyond a distance of 20 feet appeared as a "gray fog." Lights seemed to have a red ring around them, and she saw dancing black spots in front of her eyes.

Vision, with correction, was R.E. 20/50-1; L.E. 6/200. Tension, taken with a Schiötz tonometer, was normal. External examination was negative. A bilateral veil of vascular network was seen extending into the vitreous from the disc to +12. Some small hard exudates and a few faint macular hemorrhages were seen. Examination of the urine showed specific gravity 1.032 and 4+ sugar reduction.

One week later, following homatropine-paredrine refraction, vision was R.E. 20/40-2; L.E. 20/200. At the present time, four months after onset, corrected vision was R.E. 2/200; L.E. ability to count fingers at 3 feet. Light projection and perception and central fixation were good. Red and green were named correctly. The vascular tree was not elicited in either eye. No fundus details were visible. The rete mirabile was present in each eye. In the vitreous of the right eye, at the 2-o'clock position, was a hemorrhage which showed early organization.

#### OLD EXTENSIVE OCULAR TRAUMA

DR. WILLIAM ROSENBERG presented M.P., a 52-year-old man, whose complaint in September, 1942, was loss of vision in the left eye of 25 years' duration, and fogging of the vision in the right eye of

5 years' duration. Vision, R.E., was 20/25 with +3.50D. sph.  $\approx$  +2.00D. cyl. ax. 85°; L.E. 10/200, with good fixation and projection; red and green were easily identified and the vascular tree was elicited in that eye.

Twenty-five years ago some iron chips had entered his left eye. Attempts to remove them with a giant electric magnet were unsuccessful. Enucleation was advised but was not performed. X-ray studies were not made. Since that time he had felt that the left eye was useless, although the vision had cleared. In the past five years he had been aware of spots in front of the right eye which moved with the eye.

Examination under paredrine homatropine cycloplegia improved the vision in the right eye to 20/16-4 with +3.25D. sph.  $\approx$  +2.75D. cyl. ax. 90°. Vision in the left eye was improved to 20/16-3 with +11.25D. sph.  $\approx$  +1.50D. cyl. ax. 95°. The fundus of the right eye was normal; slitlamp examination showed three superficial punctate opacities on the corneal vertex of the right eye. Examination of the left eye showed a corneal pathway with a rent in Descemet's membrane at the 10:30-o'clock position, 2 mm. from the limbus, leading to a hole in the iris at the 11-o'clock position. The anterior chamber was clear, though a few wisps of vitreous extruded into the chamber nasally. There was iridodonesis; no lens substance was visible although remnants of the posterior capsule were seen. There were several fine vitreous opacities. In the superior nasal quadrant, corresponding to the superior nasal vortex-vein emissaries, there was a large area of choroidal sclerosis. X-ray pictures of the orbit revealed no foreign body. It had apparently dissolved. The patient was fitted with a minifying lens (Catmin) and has fusion on the synoptoscope.

The diagnosis was traumatic corneal opacity and rupture of Descemet's mem-

brane, hole in the iris, traumatic aphakia, traumatic superior nasal vortex-vein occlusion, and vitreous detachment, left eye.

#### CATARACTA COMPLICATA—ECTOPIA LENTIS

DR. WILLIAM ROSENBERG said that J. F. H., a 65-year-old man, gave a history of gradually decreasing vision for the past 15 years. He had been told that his vision was poor because of trauma, although he could recall only minor blows to his eyes. He was also told, seven years ago, that he had the beginning of a cataract in his right eye.

The vision in the right eye was 9/200; with the left eye he could count fingers at one foot. Light projection was quick and accurate and red and green were easily perceived. The vascular tree was elicited bilaterally. Examination showed marked bilateral iridodonesis with iris atrophy and bilateral dislocation of the lenses. Vitreous strands projected into the anterior chambers, and a foggy-white material was seen to surround the pupillary apertures. The pupils could be dilated only to 4 mm. The vision was improved R.E. to 20/50 with -4.50D. sph.; L.E. to 20/200 with -6.50D. sph. There was bilateral nuclear sclerosis. Many vitreous opacities were present in both eyes. The fundus of the left eye could not be seen. The fundus of the right eye, although somewhat atrophic, appeared to be otherwise normal. Visual field studies were normal. Medical and laboratory findings were essentially negative.

On June 28, 1942, a combined intracapsular loop extraction on the left eye was performed. The postoperative course was uneventful. Final manifest refraction improved the vision of the left eye to 20/30-3 with +9.75D. sph.  $\approx$  +3.50D. cyl. ax. 115°, and the patient was able to read newsprint rapidly with the addition of +3.00D. sph.

The diagnosis was bilateral subluxated

lenses, bilateral senile and complicated. RETINAL DETACHMENT  
cataracts, and bilateral uveitis.

#### PERIVASCULITIS RETINAE

DR. BARBARA SPIRO presented E. S., a 31-year-old man, who in September, 1942, gave a history of the sudden appearance of a black streak in the upper visual field of his right eye, nine months previously. This cleared up in a day, and recurred six months later. He saw an eye physician who diagnosed an infected eye and treated him with injections. Five teeth were extracted to eliminate a possible focus of infection. There was no history of pain, redness, or tenderness of the eye.

The vision R.E. was 20/200, not improved under cycloplegic refraction; L.E. 20/13-4. The left eye was essentially normal. The vitreous of the right eye was hazy, containing a membranous opacity with dark-green nodules and black opacities. The vessels were thin and indistinct. A number of hemorrhages were seen around the macula and temporally in the periphery. A white mass, 1 P.D. in size, was observed temporal to the disc at the 9-o'clock position, with many small capillaries enmeshed in it. Similar masses were seen in the periphery. Slitlamp examination showed multiple golden deposits on the posterior surface of the cornea and in the anterior chamber and a few cells in the anterior vitreous.

Physical and laboratory findings showed no abnormalities. Two weeks later the vision in the right eye was 20/25 and the vitreous had cleared markedly. Four weeks later the vision was 20/16 and has remained so since. Vitreous floaters were still present and the fundus findings were the same except for the hazy vitreous.

The impression was that this patient had perivascularitis with proliferative retinitis. He was referred to the Neurologic Department, but no evidence of central-nervous-system involvement was found.

DR. BARBARA SPIRO said that C. G., a 58-year-old woman, was first seen in April, 1942. She gave a history of having noticed flashes of light in her right eye in December, 1941. A diagnosis of detachment of the retina was made and she was treated with bed rest for three weeks. There was no history of injury to the eye.

Vision in the right eye was perception of hand movements at 4 feet, searching fixation, projection in all quadrants. Vision in the left eye was 20/13. The right eye was 10 degrees divergent. A total retinal detachment was found, extending to the disc; the highest point was seen with a +12.00 lens and the lowest point with a +8.00 lens. Old tears were present at the ora serrata and at the macula. The peripheral field of vision, taken with a flashlight, revealed a small area of vision in the upper nasal quadrant and one in the lower temporal quadrant.

Surgery was advised with poor prognosis because of long duration, completeness of the detachment, and the presence of the macular hole.

A microcoagulation detachment operation was performed on the right eye on April 27, 1942. The postoperative course was complicated by an acute upper respiratory infection. Three weeks later the retina was still elevated. Ten weeks later the retina appeared much flatter and the corrected vision was 20/200. The temporal and inferior operative reaction was more marked, with extensive pigment dispersion and white scarring. The peripheral field, taken with a 5/330 isopter, showed complete nasal constriction except for a 15-degree area surrounding the fixation point; there was about 25 degrees of temporal constriction.

Six months following operation, the corrected vision of the right eye was 20/50. The retina was fully attached, with a few faint folds in the macular area. There were some vitreous floaters,

5 years' duration. Vision, R.E., was 20/25 with +3.50D. sph.  $\approx$  +2.00D. cyl. ax. 85°; L.E. 10/200, with good fixation and projection; red and green were easily identified and the vascular tree was elicited in that eye.

Twenty-five years ago some iron chips had entered his left eye. Attempts to remove them with a giant electric magnet were unsuccessful. Enucleation was advised but was not performed. X-ray studies were not made. Since that time he had felt that the left eye was useless, although the vision had cleared. In the past five years he had been aware of spots in front of the right eye which moved with the eye.

Examination under paredrine homatropine cycloplegia improved the vision in the right eye to 20/16—4 with +3.25D. sph.  $\approx$  +2.75D. cyl. ax. 90°. Vision in the left eye was improved to 20/16—3 with +11.25D. sph.  $\approx$  +1.50D. cyl. ax. 95°. The fundus of the right eye was normal; slitlamp examination showed three superficial punctate opacities on the corneal vertex of the right eye. Examination of the left eye showed a corneal pathway with a rent in Descemet's membrane at the 10:30-o'clock position, 2 mm. from the limbus, leading to a hole in the iris at the 11-o'clock position. The anterior chamber was clear, though a few wisps of vitreous extruded into the chamber nasally. There was iridodonesis; no lens substance was visible although remnants of the posterior capsule were seen. There were several fine vitreous opacities. In the superior nasal quadrant, corresponding to the superior nasal vortex-vein emissaries, there was a large area of choroidal sclerosis. X-ray pictures of the orbit revealed no foreign body. It had apparently dissolved. The patient was fitted with a minifying lens (Catmin) and has fusion on the synoptoscope.

The diagnosis was traumatic corneal opacity and rupture of Descemet's mem-

brane, hole in the iris, traumatic aphakia, traumatic superior nasal vortex-vein occlusion, and vitreous detachment, left eye.

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Six months following operation, the corrected vision of the right eye was 20/50. The retina was fully attached, with a few faint folds in the macular area. There were some vitreous floaters,

but the patient complained only of diplopia.

#### IMPLANTATION CYST

DR. G. HENRY MUNDT said that this patient, a 66-year-old white man, came to the Clinic in November, 1938, and stated that a cataract extraction had been performed on the left eye seven years previously and on the right eye five years previously, in Italy.

Vision R.E. was 0.4; L.E. 1.0 (corrected). The following findings were noted: chronic trachoma, both eyes; bilateral aphakia; bilateral pterygium; iridectomy, left eye; and corneal nebulae. The tension was normal in each eye. Slit-lamp examination showed proliferated epithelium and multiple yellow crystals in the posterior lens capsule of the left eye.

When the patient returned in March,

1941, a lesion filled with fluid was noted at the 9-o'clock position on the iris of the left eye, approximately 3 to 4 mm. in size. The pterygium was removed from the right eye. In May, 1941, he complained of tearing of the left eye. Fluorescein passed through the punctum and tear duct into the nose without difficulty.

He was observed at monthly intervals, receiving treatment for trachoma. In August, 1942, the corrected vision was R.E. 20/50, L.E. counting fingers at 6 feet. He still complained of tearing. Slitlamp examination showed epithelial proliferation over the surface of the posterior capsule, with several small cystic areas. The cyst on the iris had increased in size. A diagnosis of implantation cyst, in addition to a finding of Elschnig's pearls, was made, and X-ray therapy was advised.

Robert Von der Heydt.

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## TREACHERY IN OPTICS

We are told that the fighting forces of the United States now number something like ten million. Generally speaking, these men represent perhaps the finest assembly of physical manhood that the world has ever seen. Many of them, unfortunately, will never return to their homes.

In combat, whether of land, sea, or sky, much depends upon the visual efficiency of this great body of fighters and auxiliaries. Some of them have been accepted for service in spite of the fact that their visual acuity without correction is a good deal short of normal, and that their effi-

ciency must depend chiefly upon the wearing of correcting lenses. But in certain fighting services no significant degree of optical defect is tolerated. The requirements for officers of the Army and Navy are considerably higher than for the rank and file. The standards for the Navy and Marines are higher than those for the Army. Most exacting of all are the visual conditions laid down for the Air services.

As to every branch there is good reason for the visual standards prescribed. In all walks of life we are familiar with the handicaps created by imperfect ocular function. The schoolboy who reads badly

may do so either because of actual inability to see or because he has an eye fatigue which reduces his power of visual and mental concentration. Poor vision or eye fatigue in a workman is not infrequently responsible for injury or death to the man himself or to those around him. In like fashion, imperfect visual function may result in death and disaster among the armed forces.

Applicants for jobs with railroads or other industrial concerns often resort to special tricks in order to deceive the examiner. Sometimes they are successful, and by their scheming have added to the industrial hazard. The penalty paid by the individual, the organization, or the community may be serious.

The applicant for a special line of activity in the fighting forces may be shocked to find that he does not meet the visual requirements. It may be that he is genuinely desirous of giving the utmost possible service to his country in the emergency. Perhaps he would rather be an officer than a private, rather an air pilot than a ground worker. Frequently his first reaction is that the visual standard is unduly strict, that he is experiencing a personal injustice, and that the rule represents an obstacle which he should attempt to overcome. He forgets that such rules have usually been created out of the lessons of experience.

Somewhere around the recruiting station, or elsewhere, the disappointed applicant encounters someone who assures him that a certain "doctor" knows how to cure such optical imperfections. The candidate thinks the matter over and proceeds to visit the so-called "doctor," who, for anywhere from fifty to a couple of hundred dollars, undertakes to put the patient in a position to hurdle the service barrier. Usually, all the candidate gets for his money is disappointment and disgust, but now and then, either through devious

methods or by the aid of certain mechanical "exercisès" which stimulate a temporary forcing of accommodative or muscular adjustment, he succeeds in passing the test.

What happens to such a candidate? His inadequacy may be disclosed at some later stage of induction or training. Or he may have the good luck, especially if otherwise possessed of the best possible mental and physical equipment, to do valuable and efficient service. But he faces the risk that a visual breakdown, at some critical moment, will work mischief to himself and others.

It must be remembered that not only does bodily fatigue have a marked capacity to reduce ocular efficiency in the presence of a refractive or muscular defect, but eyestrain itself not infrequently causes general fatigue, with incidental reduction in central control. The hyperope, the astigmatic subject, even the myope who when in the pink of condition is able to force his visual apparatus to its peak of achievement, may find his efficiency seriously impaired in times of weariness or crisis. His hurdling of the visual barrier may then render him rather a liability than an asset to the armed forces.

Certain claims have been made as to ability to overcome, by training, the ordinary imperfections of red-green color vision. But careful research clearly indicates that any apparent success in this direction has been spurious and has depended upon acquiring, by infinite repetition, an extreme familiarity with the arrangement of a series of cards used in the testing of color vision. The individual who had gone through such a course of training would be just as likely to prove dangerous as any other victim of red-green color-blindness.

The man who has to undergo special training in order to cross the boundary line of visual requirement for a special

service would be wiser and more patriotic to give up the attempt to enter that service. If he maneuvers his way in, he may be a potential traitor to his country. Much more specifically may the accusation of treachery be applied to the pseudo-professional tricksters who fatten on this sort of enterprise.

W. H. Crisp.

## EXERCISES TO IMPROVE VISION

Day by day the ophthalmologist is placed in an increasingly difficult position by his young patients and their parents who have heard tales of miraculous improvement of vision among their friends and acquaintances by eye exercises. Two groups are especially urgent, young men who desire to be enrolled in officers' training classes and whose vision is insufficient to meet the requirements of the armed branches in which they are interested, and, secondly, myopic girls who want good vision without glasses.

Most ophthalmologists for a long time "pooh-poohed" the idea that anything could possibly be done to help the visual acuity of these young myopic people except the prescribing of glasses. The fairly numerous cases in which visual training of one type or another has enabled a man to pass visual tests previously impossible for him are forcing the eye physician to give thought to the matter. The ever-recurring question is whether there is merit in this training that is being given. Is the visual acuity truly increased or is it the acquisition of accessory skills that gives success in those patients who do learn to read smaller letters on the vision chart? Do better psychologic approaches, the learning of tricks, or even the increased facility usually acquired by constant practice account for the results? The physician wants to know how frequently improvement can be obtained and

how this is accomplished. Most doctors have neither the time nor the inclination to study the matter through for themselves, so they either tell their patients that they have no faith in these so-called exercises or that they must seek elsewhere if they want to try them.

In most large cities there are those who are giving these exercises. They tell the prospective patient that they may not be able to accomplish anything, thus putting the responsibility on the individual and furnishing themselves an easy excuse if success is not attained, and all at a very good price.

Undoubtedly ophthalmologists have turned a deaf ear to this physiopsychologic approach to the problem of sight. The concept is so different from that taught in standard textbooks on refraction, and the theory and methods of procedure have not even appeared in ophthalmologists' literature, that they are largely hearsay to most eye physicians. To them there seems something iconoclastic, almost heretical, in disregarding the dioptric system and considering the eye merely as a link in the path of the image to the brain, a link of practically limitless potentialities unless the eye is definitely pathologic.

Perhaps the ophthalmologist does not really want to believe that it is possible to improve vision materially by these methods. He has heard that they are enormously time-consuming, requiring from five to six hours of patient training daily for many weeks, and furthermore he fears that to learn the technique; supposing that it were truly worthwhile, would require much time and effort. Oculists have seen a marked turning toward orthoptics in recent years, and most of them have disliked giving the training. Then there has been the rise of the controversial subject of aniseikonia with its very special type of examination and unusual lenses. Eye

physicians may dislike to contemplate the possibility of another expansion of visual care.

The ophthalmologist now wants to know just what value there is in this training to improve vision. He is very, very skeptical and desires to move cautiously. How can this information be obtained? There seem to be two methods. First and most satisfactory would be carefully conducted clinical experiments. The set-up for this is complicated and expensive. It really necessitates the employment of technicians familiar with the methods of training generally used who must be paid, and the coöperation of ophthalmologists who are willing to give the necessary time to supervise, check, and criticize. Then, too, there must be willing and interested subjects for the experiment and an adequate set-up of suitable instruments, all very elaborate and costly; but, fortunately, this study is apparently soon to be undertaken in at least two places in this country, so that in a reasonable length of time the harassed ophthalmologist may expect some sort of an answer to his questions.

A second criterion on these so-called exercises may sometimes be made by the oculist on his own patients, if he can maintain friendly relations with those giving the training and will encourage his patients to return to him for systematic checks. The writer has been able to do this in a few cases, thus far without having found any material improvement in the subjects, but these are admittedly unfavorable patients with relatively high myopia and many of them have not followed out the prescribed treatment fully, especially not having given the necessary time to it. Most of those who claim to have had success with this training try to insist on almost full-time work over many weeks, whereas most patients want to continue concurrently other activities, such

as school, and do the exercises in their spare moments only.

The type of pseudomyopia in which overefforts of accommodation, especially in reading, produce an associated convergence spasm, seems the only type that should reasonably yield to relaxation therapy, but this kind definitely should respond and it is probably on the favorable reaction of this fairly numerous group that most of the good reports rest.

Another point of view with regard to this visual training is presented in the first editorial in this issue, a viewpoint that certainly warrants careful consideration and is one more reason for attempting to arrive at some conclusion in the matter.

Lawrence T. Post.

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## BOOK NOTICE

AN INTRODUCTION TO CLINICAL PERIMETRY. By H. M. Traquair, M.D., F.R.C.S. 4th edition. Clothbound, 332 pages, 245 illustrations and 3 colored plates. London, H. Kimpton, 1942. Price \$6.50.

This fourth edition of Traquair's highly regarded book, making its appearance in a war year, shows some change in its make-up, but little alteration in the text (see review of third edition, this Journal, 1938, v. 21, p. 1049). The book, as before, consists of 12 chapters. The early part of the book presents Traquair's classical concept of the nature and significance of the field of vision, forming the basis for the "quantitative" approach to perimetry. The second half of the book is a systematic description of the perimetric changes produced by disease of each part of the visual mechanism.

Several clinical entities receive a more thorough exposition in this new edition. Among these are a more careful elucidation

tion of the types of perimetric changes shown in Jensen's chorioretinitis juxtapapillaris; a description of the Foster-Kennedy syndrome; and a paragraph on optico-chiasmic arachnoiditis.

The portion of the Appendix dealing with the "Anatomical relations of the visual pathway" (section III; also sections IV and V) has always seemed, to this reviewer, to be of paramount importance in the appreciation of the perimetric changes for each part of the visual mechanism. The inclusion of eight new figures helps to focus the reader's attention on this section. They facilitate the organization of these anatomic relations into a mental picture which is necessary to the proper evaluation of the text. It is to be hoped that future editions will further emphasize this topographic-anatomic section.

This new edition is printed on thinner, less glossy paper, and there has been a reduction in over-all size, weight, and, best of all price.

Benjamin Milder.

## OBITUARIES

### AN APPRECIATION OF ALFRED VOGT 1879-1943

With the passing of Prof. Alfred Vogt, of Zürich, ophthalmology has suffered the loss of one who without a doubt has made the greatest contribution to ocular clinical diagnosis during the past quarter of a century.

His early studies of radiant energy and spectral analysis centered mainly on experimental work on the effects of ultraviolet and infrared light on ocular structures. The injurious effects of infrared light in industry and the possibility that with it cataracts could be made to order were disclosed. He showed the relative innocence of ultraviolet light, the sup-

posed damaging effect of which, in his own words, had always been the "whipping-boy" in ophthalmologic literature.

Vogt's development of filters of copper sulphate and erioviridin B which, with an arc light as source of illumination, allowed of the examination of the fundus with red-free light, was a great advance in ocular diagnosis (1913).

By means of this illumination the yellow coloration of the macula could be observed in the living eye. There is an increased visibility of the nerve-fiber striation and in the reflection of retinal folds. The minute blood vessels could be followed practically into the macula. The progression of macular vacuole formation could be better observed. Macular pigment changes, especially the diagnosis of fresh pigment formation, which is yellow, may be differentiated from small black hemorrhages. In order to have a complete elimination of all red a microarc light had to be the initial source of illumination, as the filters excluded 97 percent of the light, leaving but 3 percent for observation.

The use of the older type of ophthalmoscope with mirror was necessary. Effort was made by manufacturers to circumvent these important necessities by building filters into the various types of electric ophthalmoscopes. This resulted in a semi-red-free illumination, thus defeating the real value of Vogt's method. Among Professor Vogt's publications are two monographs on red-free light.

His first "Atlas of slit lamp microscopy of the living eye" was published in four languages: German, English, French, and Italian (1921).

The second edition presented his life work, appearing in three large volumes (1930, 1932, 1942). The many thousands of colored illustrations were a monumental artistic achievement, not as yet equaled.



His book on the "Pathogenesis and operative therapy of retinal detachment" (1936) was a timely follow-up of the work of his fellow Swiss countryman Gonin.

During three decades ophthalmologic and medical journals continually carried a steady stream of Vogt's new contributions.

His investigation in genetic biology and on heredity culminated in the publication of an intensive study of senile changes in identical twins (*Klinische Monatsblätter für Augenheilkunde*, April, 1938). This contributed much of confirmative value to our knowledge of the many new evidences of ocular senility which he disclosed by the use of the slitlamp.

Among the many new uses of the latter was his utilization of the reflection of light on delimiting ocular surfaces. It allowed of a visibility of the individual endothelial cells on the posterior corneal surface. Here, and in this way only, individual living fixed cells may be seen.

Most important and of immense practical clinical value was Vogt's introduction of the very narrow slitlamp beam (1918-20), the utilization of an extremely thin optical cross-cut section. By means of this method the beam if well focused allowed of an accurate determination of depth within media. Thickenings as well as thinnings in certain areas of the cornea could be seen and compared. The topographic anatomy and histology of the lens, its nuclear zones and lamellae were accurately seen for the first time by means of this narrow beam. It also allowed of an exact determination of the ages of the many concentric nuclear zones.

Previous to these refinements slitlamp observation was limited to focal illumination and transillumination. These, however, disclosed such a wealth of new, heretofore unknown clinical pictures that many were astounded to observe this

new world and were much enlightened. Hence the well-focused narrowed-beam refinement, with its increased possibilities, was usually overlooked, except by Vogt's disciples and followers. These, however, are obtaining a maximum of valuable clinical information.

A new era, bringing inestimable diagnostic possibilities as well as an interesting office diversion, has been the happy fate of Professor Vogt's followers. The use of the slitlamp at an expense of but little time has taught the art of accurate observation.

In 1939 his associates and friends from all over the world had published a *Festschrift* containing almost 100 articles to commemorate his sixtieth birthday.

He told me of his kidney involvement 20 years ago. In spite of this progressive affliction he had kept up a prodigious amount of clinical work, painstaking investigations, and had conducted a large private practice, drawn from all over the world.

So again, another ophthalmologic giant has passed on to immortality.

Robert von der Heydt.

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#### SANFORD R. GIFFORD 1892-1944

American science in general and Chicago ophthalmology in particular suffered a grievous loss in the all too untimely death of Sanford R. Gifford on the twenty-fifth of February of this year. Up to eight days before, he had been feeling well, although extremely tired from the enormous overload of his University and private work. Four days later he entered the Passavant Hospital in a serious condition, and finally succumbed to pneumonia. In accordance with his expressed wish, a simple funeral service was held.

Sanford R. Gifford, born in Omaha on January 8, 1892, was the son of an

equally famous father, Harold Gifford, who left a great imprint upon American ophthalmology. His undergraduate collegiate work was completed at Cornell University, where he majored in literature. Later he received an M.A. degree from the University of Nebraska, and his M.D. degree from the same school in 1918. Following a short internship in Wise Memorial Hospital in Omaha, he enlisted in the Army and was assigned as bacteriologist to Base Hospital 49 in Allery, France, with the University of Nebraska Unit, and later served with the Army of Occupation.

After his discharge from the Army, he went to the Nebraska Methodist Hospital, in Omaha, for a two-year internship, and then entered practice with his father in that city, and at the same time was active in the University Ophthalmic Clinic. He spent the year of 1923 studying in various clinics and centers in Europe, including the Augenlinik in Freiburg, under Professor Axenfeld; at the Tübingen and Vienna clinics; with Morax in Paris; and at Moorfields in London. Publications of both clinical and investigative work began to flow from his pen, and soon the ophthalmologic profession became aware that there was another and greater Gifford on the horizon. In 1929 he was called to the Chair of Ophthalmology in Northwestern University Medical School, and shortly thereafter moved his residence to Chicago. Omaha's loss was Chicago's gain, for his ability and personality soon put him among the leaders of the profession.

There were four separate aspects to Dr. Gifford's professional life: his clinical work, his investigative work, his teaching, and his private practice; and I believe that subconsciously his interest rated them in that order. Although a research man of the first order, he was primarily a clinician, and as such his experience

and judgment commanded national respect. His ophthalmic surgery was bold, and he pioneered in many fields of ocular therapy, but the safety and integrity of the eye under his knife was his first consideration. From a therapeutic standpoint, Sanford Gifford was undoubtedly the leader in this country, not only by his own work, but even more through his



Sanford Robinson Gifford, M.D.

outstanding "Handbook of ocular therapeutics." Even before his advent into medicine, he exhibited the mental curiosity of a true research man. He always wanted to know the why and wherefore of a problem, and that attitude led to some of his major investigative publications. The following are indicative of the scope of his work in this field:

Biochemistry of the lens. With Drs. J. E. Lebensohn and I. S. Puntenney: *Archives of Ophthalmology*, 1932, v. 8, p. 414; and *American Journal of Ophthalmology*, 1933, v. 16, p. 1050.

Visual sensation produced by roentgen and radium rays. With E. E. Barth: *Archives of Ophthalmology*, 1934, v. 11, p. 81.

Reaction of buffer solutions and of ophthalmic drugs. *Archives of Ophthalmology*, 1935, v. 13, p. 78.

Filtration experiments with the virus of inclusion blennorrhea. With E. B. Tilden: *Archives of Ophthalmology*, 1936, v. 16, p. 51.

Tendon transplantation for paralysis of the external rectus muscle. *Archives of Ophthalmology*, 1940, v. 24, November.

Central angiospastic retinopathy. *Archives of Ophthalmology*, 1939, v. 21, February.

Dr. Gifford was perhaps somewhat too impatient to be the ideal undergraduate teacher, but as a teacher of graduate students who approached his own mental level, he had no peer. Still his "Textbook of ophthalmology" for undergraduates is one of the outstanding manuals of its type; only those of May and Parsons are comparable. Under his inspired leadership the Department of Ophthalmology at Northwestern has done much to further the knowledge of this specialty among physicians in general practice. Furthermore, he had that rare gift of developing a "school" of young men, imbued with his ideals and following in his footsteps. Private practice was somewhat of a chore, although he enjoyed the human contacts involved, as well as the diagnostic problems associated with a large referred practice.

Sandy Gifford was the best "company" that a person could hope to have. Uniformly cheerful, he could always see the quirks in a situation, which he could usually top with an appropriate quip. He was very well read, especially in general science, and his memory was of the encyclopedic type. The French and German languages were second nature to him, and during the first Pan-American Con-

gress of Ophthalmology, he delivered an impromptu speech in Spanish from the floor of the meeting. I well remember his earnest, albeit somewhat abortive attempts to master Arabic while we were attending the International Congress of Ophthalmology in Egypt, in 1937. Written English was quite a hobby, and he belonged to a literary society in Chicago, before which he delivered his famous essay on "Garlic and horseblankets," a masterpiece of analysis of the patients he saw in Omaha during his earlier days.

A very happy home life was his lot. Alice Carter Gifford maintained a smooth-functioning household and was the ideal helpmate for Sandy. The oldest son, Sanford, a graduate psychiatrist, is now in the Army, and the younger son, Carter, an undergraduate architectural student, is on duty with the Seabees.

We are going to miss Sandy more and more as time goes on. His influence on Chicago ophthalmology was great and was of that type that cannot be replaced easily. But for those of us who had the happiness of his friendship, there is a great void, an emptiness that his passing has left. Our sorrow is that of self-pity, for we think of Sandy and the joy that he gave us as The Immortal Bard has put it into the mouth of Claudius, King of Denmark,

"That we with wisest sorrow think on  
him  
Together with remembrance of ourselves."

Harry S. Gradle.

# ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

## CLASSIFICATION

- |  |  |
|--|--|
| 1. General methods of diagnosis                        | 10. Retina and vitreous                                |
| 2. Therapeutics and operations                         | 11. Optic nerve and toxic amblyopias                   |
| 3. Physiologic optics, refraction, and color vision    | 12. Visual tracts and centers                          |
| 4. Ocular movements                                    | 13. Eyeball and orbit                                  |
| 5. Conjunctiva   | 14. Eyelids and lacrimal apparatus                     |
| 6. Cornea and sclera                                   | 15. Tumors   |
| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries   |
| 8. Glaucoma and ocular tension                         | 17. Systemic diseases and parasites                    |
| 9. Crystalline lens                                    | 18. Hygiene, sociology, education, and history         |
|  | 19. Anatomy, embryology, and comparative ophthalmology |

### 3

#### PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Luckiesh, Matthew. Test charts representing a variety of visual tasks. *Amer. Jour. Ophth.*, 1944, v. 27, March, pp. 270-275. (2 figures, 1 table, references.)

Messenger, H. K. Principles of refraction. *Med. Clinics North America*, 1942, v. 26, Sept., pp. 1595-1614.

The first half of this paper is a review of the basic principles of refraction, under the following headings: rays; object and image points, focus; the measurement of vergence; a simple means of calculating the distance of an image; the forms of an ophthalmic lens; refraction of the eye. The second half of the paper offers "a simple subjective method" for the correction of refractive errors, dealing with the determination of axis, cylinder, and sphere. (13 figures.) W. H. Crisp.

Pascal, J. I. A rational basis for cross-cylinder tests. *Amer. Jour. Ophth.*, 1944, v. 27, March, pp. 280-281.

Pascal, J. I. Simple transposition of obliquely crossed cylinders. *Dis. Eye, Ear, Nose, and Throat*, 1942, v. 2, Nov., p. 349.

The author points out the practical usefulness of learning to transpose obliquely crossed cylinders to give insight into cross-cylinder work and cylindrical corrections generally. The mathematical method of accomplishing this transposition is explained.

Robert N. Shaffer.

Solandt, D. Y., and Best, C. H. The Royal Canadian Navy color-vision test lantern. *Canadian Med. Assoc. Jour.*, 1943, v. 48, Jan., p. 18.

The construction of the Royal Canadian Navy color-vision-test lantern is described. It presents to the patient two white or colored lights which give a dimensional representation of the riding lights of a vessel with a beam of 25 feet at 2,000 yards. Various combinations can be used. By its use some 30 percent of those failing in the Ishihara test will pass. The authors think a large percentage of such patients have

strictly normal color vision, and that the others are anomalous trichromates with only slight defects. Test procedures are outlined and the evaluation of data obtained is discussed.

Robert N. Shaffer.

Sugar, H. S. Binocular refraction with cross-cylinder technique. *Arch. of Ophth.*, 1944, v. 31, Jan., pp. 34-42.

Many persons who wear corrective lenses the prescription for which has been determined by accurate monocular refraction are uncomfortable during binocular vision. In many cases, says the author, the trouble is due to changes in the astigmatic axes when both eyes are used together for distant vision and during convergence accommodation. The paper analyzes such changes in a small series of 70 normal eyes with astigmatism of 1.00 D. or more, and explains the use of the cross cylinder to determine these changes under binocular fixation. All the patients had binocular single vision. Four explanations have been advanced; namely, lenticular changes, fusional compensation, torsional movements of the globe, and action of the extrinsic muscles in changing the curvature of the cornea.

The author has used the cross cylinder not only for binocular determination of the axis of cylinders for distance, but, more recently, for binocular determination of the axis of astigmatism for near vision when reading glasses alone were required. A table shows the change in axis from monocular to binocular testing as found in many cases.

As an additional conception in the attempt to get comfort with the binocular correction in difficult cases, the author takes up the subject of spherical equivalent. The spherical equivalent of a

compound lens system corresponds to the dioptric midpoint of the interval of Sturm. Numerically, the spherical equivalent of a compound lens system in plus-plus or minus-minus combinations is equal to the spherical power of the system plus half the power of the cylinder. The spherical equivalent of a simple cylinder is equal to half the power of the cylinder.

A series of case reports is given showing the application of the spherical equivalent. The following combinations all have the same spherical equivalent: - 2.75 D. sph. + 2.00 D. cyl. axis 100°; - 2.50 D. sph. + 1.50 D. cyl. axis 100°; - 2.25 D. sph. + 1.00 D. cyl. axis 100°; - 2.00 D. sph. + 0.50 D. cyl. axis 100°.

In a given case these combinations were tried in the order listed. The most comfortable combination may be tried in a trial frame in the waiting room for a half hour as a test. In this particular case the third combination gave comfort and was prescribed. The visual acuity with this system was 20/25. (5 charts, references.)

R. W. Danielson.

#### 4

#### OCULAR MOVEMENTS.

Berens, C., and Romaine, H. H. Post-operative cicatricial strabismus: results of the transplantation of Tenon's capsule. *Trans. Amer. Acad. Ophth. and Otolaryng.*, 1943, 47th mtg., Jan.-Feb., pp. 183-205.

This study was carried out in rabbits, using various techniques. The grafts used were free, pedicle, and apron; the substances, Tenon's capsule, amnioplastin, egg membrane, and peritoneum. Adhesions were produced by manipulation, scarification, and abrasion of the muscle with an instrument.

Pedicle grafts produced the best results. The apron graft apparently forms a tunnel in which the muscle acquires greater motility. Amnioplastin, egg membrane, and peritoneum were found unsatisfactory as substitutes for Tenon's capsule. Rough manipulation of the muscles or capsule produced adhesions, so that it is important to exercise the greatest care to avoid trauma to these structures. Reaction from suturing and from suture material should be avoided if possible. A suture material, nylon (6-0), has been used very successfully. In cases of complete fixation of the muscle to the sclera, transplantation of Tenon's capsule definitely improves motility.

Clinical reports of four typical cases are presented. Case 1 records a good result in postoperative cicatricial exotropia, case 2 a bad result in postoperative cicatricial exotropia, case 3 a good result in cicatricial exotropia following a second transplantation of Tenon's capsule in a patient whose cosmetic appearance and functional result had been worse after the first transplantation of Tenon's capsule, case 4 a good result in postoperative cicatricial esotropia. A table showing the findings in the 21 operations is included. (6 tables, 9 illustrations.)

Gertrude S. Hausmann.

Davis, W. T. Differential diagnosis of paresis of the obliques and the superior and inferior recti muscles. *Trans. Amer. Acad. Ophth. and Otolaryng.*, 1943, 47th mtg., Jan.-Feb., pp. 206-209.

This paper was illustrated by a film, depicting the various types of paralysis of the ocular muscles. Until Bielschowsky formulated the differential diagnostic signs between palsy of the superior and inferior recti and the obliques, paresis of the vertically acting recti

was frequently confused with that of the obliques. The outstanding differences are as follows: In palsy of the right superior oblique or of the left superior rectus, if the patient looks up and left there is a high amount of right hyperphoria, from overaction of the right inferior oblique. In palsy of the right superior oblique, if the head is tilted toward the right shoulder, there is little or no vertical deviation. In palsy of the right superior rectus no change in vertical deviation occurs on tilting the head toward either the right or the left shoulder.

Gertrude S. Hausmann.

Foster, J., Pemberton, E. C., and Freedman, S. S. Graded squint operations. *Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, pp. 320-329.

The authors tabulate the results obtained with the number of millimeters of recession or resection and the degree of squint corrected. The operations were carried out under general anesthesia up to 14 years of age, and under local anesthesia above that age.

One-mm. recession of the internal rectus produced an average of 2.9° correction. One recession in four produced a surprise result, and squints which were variable prior to operation remained variable after operation. The unintended vertical displacement obtained in a simple recession or advancement could not be controlled by raising or lowering the insertion of a horizontal muscle. (3 tables, 1 diagram, references.)

Beulah Cushman.

Guibor, G. P. Recession of the inferior-oblique muscle from the external-rectus approach. *Amer. Jour. Ophth.*, 1944, v. 27, March, pp. 254-257. (13 illustrations, references.)

Harris, Wilfred. **Ataxic nystagmus. A pathognomonic sign in disseminated sclerosis.** *Brit. Jour. Ophth.*, 1944, v. 28, Jan., pp. 40-42.

The author reports a condition he calls ataxic nystagmus. The eyes turned laterally and the conjugate action appeared weak. The right eye, when looking toward the left side, did not reach the inner canthus. At the same time the left eye showed a coarse nystagmus, as though outward movement could not be maintained because of weakness. Usually the nystagmus of the left eye continued as long as the patient looked to the left, the right eye remaining stationary in its position short of the inner canthus. It was this discrepancy between the movements of the two eyes which suggested the term "ataxic nystagmus." Three case reports are given. Beulah Cushman.

Lynn, Beatrice. **The treatment of concomitant and latent squint.** *Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, pp. 344-351.

The author outlines the results obtained five years after the inauguration of an orthoptic department in two hospitals. The steps in the treatment were estimation of the error of refraction, occlusion to prevent or overcome amblyopia exanopsia, establishment of simultaneous macular perception, increasing power of fusion, and correction of deviation (by operation, if necessary), together with version and vergence exercises and stereoscopic vision.

Among the stimulating exercises advised for suppression is frequent attendance of the cinema or teaching by cine-projectors, because the amblyopic eye sees moving objects more easily than stationary ones. Observations seem to demonstrate that if a child has

a squint before the age of two years it is unlikely that fusion will be established, but it is of vital importance to prevent amblyopia and to increase the lateral movement of each eye. Suppression must be overcome before a strong sense of fusion can be established. When this has been done, operative procedures may be undertaken and exercises resumed. (One table, 3 diagrams.) Beulah Cushman.

Spaeth, E. B. **Congenital blepharoptosis—a classification. The principles of surgical correction.** *Trans. Amer. Acad. Ophth. and Otolaryng.*, 1943, 47th mtg., March-April, pp. 285-300.

The importance of early diagnosis and treatment of congenital ptosis is stressed. Of the cases here discussed, 37 percent were complicated by such symptoms as muscle imbalance and torticollis, loss of vision either single or binocular, curvature of the spine, and spasm of the occipitofrontalis. The cases are divided into nine groups: (1) unilateral ptosis without involvement of the superior rectus muscle, (2) unilateral ptosis with involvement of the homolateral superior rectus muscle, (3) bilateral ptosis without involvement of the superior rectus muscle, (4) bilateral ptosis with involvement of the superior rectus muscle, (5) unilateral ptosis with weakness of both superior recti muscles more marked in the homolateral eye, (6) ptosis with more or less complete third-nerve and even sixth-nerve paralysis, (7) ptosis with the classical jaw-winking reflex, (8) ptosis with Duane's retraction syndrome, (9) ptosis with neurofibromatosis. The three main principles to be considered in surgery for correction of ptosis, all of them necessary at various times in these cases, are: use of the occipitofrontalis, use of the superior



## 5

## CONJUNCTIVA

Perkins, J. E., Korns, R. F., and Westphal, R. S. Epidemiology of epidemic keratoconjunctivitis. *Amer. Jour. Pub. Health*, 1943, v. 33, Oct., pp. 1187-1198.

During five months beginning September, 1942, an extensive epidemic of keratoconjunctivitis was studied in a Schenectady factory. For military reasons, the names and the number of cases involved are not given. Approximately 4 percent of the entire personnel were affected, and of these 56.1 percent showed the disease in both eyes and 85.5 percent developed corneal opacities. In only 19 percent had the corneal opacities disappeared at the end of two months. The peak of the epidemic was reached five weeks after onset, and after this the epidemic subsided gradually until the thirteenth week, when a slight increase again occurred. The groups most affected were first physicians and nurses, and next, employees exposed to ocular foreign bodies. A higher rate was also noted in firemen who slept in dormitories. Secondary cases in the households of those affected were approximately 4.9 percent, most frequent in adult females and milder in children. The cause is probably a virus transmitted from person to person (respiratory?). Only a small percentage of those exposed, however, develop clinical symptoms. The virulence of the virus, the amount of exposure, and the resistance of the host are apparently the factors which determine who will be infected and how severely. A rigid aseptic technique was employed, consisting of washing hands routinely between patients, using a separate sterilized dropper for each pa-

rectus muscle (if normal) and shortening of the levator. General ptoses, classified under 1, 2, 4, 5, and very occasionally 9, are best corrected by levator advancement with usually partial tarsectomy. Ptosis classified under 3 is the ideal indication for the Mottais-Parinaud technique. For ptosis classified under 6, early extraocular muscle surgery is important. It should be completed before the ptosis itself is corrected. For ptosis classified under 7 and 8 a complete tenotomy with tenectomy of the levator should be followed several weeks later by a Reese orbicularis transplant to the occipitofrontalis. Ptosis classified under 9 should usually be corrected by a Hess procedure. (21 illustrations.)

Gertrude S. Hausmann.

Wheeler, J. R. A review of the treatment of concomitant and latent strabismus. *Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, pp. 353-356.

Binocular vision, a late acquisition in phylogeny, can only be acquired postnatally. Binocular coördination probably develops between three and six months of age, but may not be stable for a number of months. From 18 months to two years development proceeds rapidly, and by six years of age binocular coördination is firmly established. Rarely does so-called concomitant strabismus commence after that age. The later the squint develops the better the prognosis. The author states that his aim in treating concomitant strabismus is to obtain two eyes cosmetically straight, and with good binocular vision. As causes of concomitant squint he cites physical defects, fusion defects, refractive errors, and sometimes a psychologic factor.

Beulah Cushman.

tient, and frequent sterilization of instruments and solutions.

Charles A. Bahn.

Terrizzano, M. F., and Terrizzano, A. J. M. Tuberculous keratoconjunctivitis treated with roentgen therapy. *La Semana Med.*, 1944, v. 51, Jan. 6, pp. 22-23.

The patient was a girl of 13 years. The disturbance involved the cornea and the conjunctiva of the right upper eyelid. Biopsy from the conjunctiva showed numerous tuberculous follicles. The interstitial keratitis was sufficiently dense to prevent a view of the iris, and the vision was reduced to light perception. Enucleation was recommended but refused. Four roentgen irradiations were given in the course of a month, each of 200 r. One similar treatment was given the next month, two in the third month, two in the fourth month, and one each in the fifth and sixth months of treatment. Eleven months after the treatment was initiated the vision of this eye had returned to normal, although there were two small corneal leucomas.

W. H. Crisp.

Wold, K. C. Epidemic keratoconjunctivitis. *Minnesota Med.*, 1944, v. 27, Jan., p. 25.

Epidemic keratoconjunctivitis is to our knowledge a virus disease characterized by an acute conjunctivitis, lid edema, lack of purulent discharge, preauricular adenopathy, and in some cases the appearance of corneal maculas which occasionally reduce visual acuity for a period of several months. Treatment is mainly symptomatic, although the use of convalescent serum or early small doses of X ray have in some cases seemed to influence the otherwise self-limited course of the disease.

Owen C. Dickson.

6.

## CORNEA AND SCLERA

Lloyd, R. I. Less evident causes of lowered acuity in senility. *Amer. Jour. Ophth.*, 1944, v. 27, March, pp. 232-243; also *Trans. Amer. Ophth. Soc.*, 1943, v. 41. (13 illustrations, references.)

Perkins, J. E., Korns, R. F., and Westphal, R. S. Epidemiology of epidemic keratoconjunctivitis. *Amer. Jour. Pub. Health*, 1943, v. 33, Oct., pp. 1187-1198. (See Section 5, Conjunctiva.)

Robson, J. M. Experimental corneal ulcers. *Brit. Jour Ophth.*, 1944, v. 28, Jan., pp. 15-25.

A résumé of the production of corneal ulcers and the application of treatment at the different stages of ulcer formation is given. The ulcers were developed by injection of *B. pyocyaneus*, *pneumococcus*, *staphylococcus aureus*, *hemolytic streptococcus*, and the human and bovine strains of the *tubercle bacillus*.

The work was started in 1940 for the purpose of investigating experimental mustard-gas lesions on the eye and their treatment. It was found that secondary infection played an important part in determining the severity of the lesions. Local treatment with chemotherapeutic agents decreased the severity of the primary reaction and also the tendency of the rabbit eyes to develop delayed vascularized keratitis. The infections produced by different types of organisms could be influenced by chemotherapeutic agents and antiseptics. The methods of administration of such drugs are compared. (2 illustrations, references.)

Beulah Cushman.

Terrizzano, M. F., and Terrizzano, A. J. M. Tuberculous keratoconjuncti-

vitis treated with roentgen therapy. *La Semana Med.*, 1944, v. 51, Jan. 6, pp. 22-23. (See Section 5, Conjunctiva.)

Wold, K. C. Epidemic keratoconjunctivitis. *Minnesota Med.*, 1944, v. 27, Jan., p. 25. (See Section 5, Conjunctiva.)

## 7

#### UVEAL TRACT, SYMPATHETIC DISEASE AND AQUEOUS HUMOR

Leathart, P. W. Parasympathetic iridoplegia. *Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, pp. 306-308.

The author uses the term parasympathetic iridoplegia to describe a condition which he has found at rare intervals following purulent sinusitis. The pupil on the side of the sinusitis is widely dilated and will not contract to light or convergence; and the near vision is blurred. The extrinsic ocular muscles and optic nerve are unaffected. The condition is exactly opposite to that found in Horner's syndrome. The lesion is located in the region of the ethmoid sinus, and involves the constrictor and convergence reflex arcs after the afferent and efferent limbs have left the third-nerve nucleus. Recovery has occurred in a few weeks without other treatment than eserine, and leaving no disability. (One diagram.)

Beulah Cushman.

Lowenstein, O., and Levine, A. S. 5. Pupillographic studies (periodic sympathetic spasm and relaxation, and role of sympathetic nervous system in pupillary innervation). *Arch. of Ophth.*, 1944, v. 31, Jan., pp. 74-94.

This paper presents detailed pupillographic study of a woman patient aged 22 years, with a syndrome of periodic sympathetic spasm and subsequent re-

laxation. Part of the time the eyes were under normal conditions and at other times they were under the effects of various drugs. The patient suffered from a progressive degenerative condition of the central nervous system, characterized by gradual development of motor and sensory disturbances, peculiar gait and periodic spastic extension at the wrist and flexion of the ulnar three fingers, which preceded by some seconds the periodic pupillary phenomena.

Impulses traveling over the sympathetic pathways produce pupillary dilatation consisting of several dilatation phases at an average speed of 0.4 mm. per second, followed by contraction at an average speed of about 0.07 mm. per second. The primary interval in the present case was 2 mm.

The light reflex of the pupil, usually considered parasympathetic, contains in its phase of contraction some factors, which are determined by the functional state of the sympathetic system, whereas the primary phase of contraction depends predominantly on the parasympathetic system. When the secondary and tertiary phases in contraction are weak, cocaine will improve them.

When the pupil is contracted with physostigmine and the primary phase of contraction is poor, it can be improved by sympathetic spasm resulting from neutralization of physostigmine by epinephrine. When the pupil becomes small because of poor sympathetic innervation, hypersensitivity to cocaine and hyposensitivity to physostigmine develop. Conversely, when the pupil becomes large under the influence of hyperinnervation by the sympathetic system, hypersensitivity to physostigmine and hyposensitivity to cocaine develop. (12 figures, references.)

R. W. Danielson.

Ray, B. S., Hinsey, J. C., and Geohegan, W. A. Observations on the distribution of the sympathetic nerves to the pupil and upper extremity as determined by stimulation of the anterior roots in man. *Annals of Surg.*, 1943, v. 118, Oct., p. 647.

Knowledge of the preganglionic sympathetic outflow to the upper extremity and pupil of man has been incomplete because of deductions from indirect methods and experimental observations of laboratory animals. In a series of 18 patients in whom the cervicothoracic region of the spinal cord was exposed and the anterior nerve roots were electrically stimulated, the following observations were made: In ten patients changes in the pupil showed that sympathetic innervation traveled through one or more roots between levels of cervical 8 and thoracic 4. In 16 patients in whom preganglionic innervation to the hand was investigated it was found that there was variation in the upper and lower levels within limits of the first and tenth thoracic. After division of all anterior roots containing sympathetic fibers to the hand there was a return of sympathetic activity within ten weeks. This may indicate a functional reorganization through other pathways. The observations emphasize the necessity for recognizing the variability in the levels of sympathetic control to the upper extremity and pupil in man.

Theodore M. Shapira.

Reese, A. B. Pigment freckles of the iris (benign melanomas); their significance in relation to malignant melanoma of the uvea. *Amer. Jour. Ophth.*, 1944, v. 27, March, pp. 217-226; also *Trans. Amer. Ophth. Soc.*, 1943, v. 41. (14 illustrations, 5 in color, references.)

## 8

## GLAUCOMA AND OCULAR TENSION

Evans, P. J. A note on iridencleisis. *Brit. Jour. Ophth.*, 1943, v. 27, Dec., pp. 548-550.

The author describes his modification of the operation of iridencleisis. He states that it is indicated in cases of noncongestive glaucoma, either chronic or subacute. If the iris is still elastic and the pupil responsive to eserine, the author makes a peripheral iridectomy by an oblique incision including only about two thirds of the withdrawn iris, but sufficiently long to provide a tongue which will reach the subconjunctival pouch through the lips of the incision. The temporal pillar is repositioned into the anterior chamber, while the nasal pillar is included in the lips of the incision. The final result retains the sphincter action of the pupil and provides an adequate fistula. Gentle massage and 0.5-percent pilocarpine are used for one to three months following the operative procedure. (2 illustrations.) Beulah Cushman.

Gibson, G. G. Transcleral lacrimal-canalculus transplants. *Amer. Jour. Ophth.*, 1944, v. 27, March, pp. 258-269. (5 illustrations.)

## 9

## CRYSTALLINE LENS

Dunlap, L. G. Safety in cataract extraction. *Trans. Pacific Coast Oto-Ophth. Soc.*, 1942, v. 27, pp. 150-155. (See *Amer. Jour. Ophth.*, 1943, v. 26, Nov., p. 1242.)

Foster, J. Preoperative cultures and antisepsis. *Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, pp. 329-335. (See Section 2, Therapeutics and operations.)

Samuels, B. Pathologic changes in the lens associated with nontraumatic iritis. *Arch. of Ophth.*, 1944, v. 31, Jan., pp. 8-17; also *Trans. Amer. Ophth. Soc.*, 1943, v. 41.

The author had described in one previous article the structural changes in a lens during the active stage of a corneal ulcer; and, in a second paper, the changes that may result long after an ulcer has been replaced by scar tissue. The present paper deals with the microscopic study of lesions occurring in a lens in nontraumatic iritis. Ordinarily a lens remains clear after a first attack of iritis. It is only after repeated attacks that opacities appear in the lens. In this study, microscopic examination was made of the lenses from twenty globes with nontraumatic iritis. A majority of the globes had been enucleated because of tuberculosis of the uvea, usually of the conglomerate type. In two globes cysticercus was discovered; one had been involved in sympathetic ophthalmia, and in one a retinoblastoma was present. In one globe the condition was mistakenly diagnosed as retinoblastoma, and two specimens showed syphilitic iritis.

In six cases in which iritis had been severe there was evidence of coincident glaucoma. In fourteen cases the capsule showed ruffling and folds. In many specimens it was noted that the disintegration of lens fibers seemed to have antedated proliferation of the epithelial cells. (8 figures, references.)

R. W. Danielson.

## 10

### RETINA AND VITREOUS

Agatston, S. A. Clinical analysis of fifty cases of diabetic retinitis. *Med. Record*, 1943, v. 156, Aug., p. 482; Sept., p. 553.

The author surveys fifty cases of diabetic retinitis. The duration and severity of diabetes are not definitely related to the retinitis, nor does complete control of diabetes arrest the retinitis. Absence of changes in retinal veins and arteries is a favorable prognostic sign. The author thinks the first sign of retinitis is not lipid exudate but petechial capillary hemorrhage. Venular and capillary pathology offers the most logical explanation of fundus pictures, because the advanced retinal changes are so frequently out of proportion to existing arterial or renal disease. The presence of engorged retinal veins indicates a tendency to thrombosis with danger of large hemorrhages. Such changes render an eye unfavorable for intraocular surgery, because of the probability of postoperative hemorrhage.

Robert N. Shaffer.

Berens, Conrad. An illuminated retractor for eye operations, especially for detachment of the retina. *Amer. Jour. Ophth.*, 1944, v. 27, March, p. 281. (One figure.)

Black, G. W. Detachment of the retina. *Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, p. 311.

The author reports a case of bilateral detachment of the retina treated by the Guist operation upon the right eye in 1933, and in which in 1940 extracapsular lens extraction was performed on the same eye with final visual acuity of 6/24 with +5.00 sphere.

Beulah Cushman.

Dickson, W. E. C., Pritchard, G. C., Savin, L. H., and Sorsby, A. Two cases of visible emboli in retinal arteries. *Brit. Jour. Ophth.*, 1944, v. 28, Jan., pp. 1-14.

The author gives two cases of visible

obstruction of retinal arteries. For one case histologic illustrations were obtained. In one case there was a heart lesion with vegetations, complicated by embolic processes, in the absence of arteriosclerotic changes or thrombus formation. (19 illustrations.)

Beulah Cushman.

Eisaman, J. L. **Chronic occlusive arterial disease (arteriosclerosis obliterans), associated with retinitis pigmentosa.** *Amer. Heart Jour.*, 1943, v. 26, Dec., p. 836.

A 56-year-old male gave a history of chronic occlusive arterial disease affecting particularly the lower extremities. Associated with this condition there was a typical picture of retinitis pigmentosa with no apparent familial background. This case suggests that pathologic changes may not be localized in the retina but may occur as a part of a similar disorder elsewhere in the body.

Owen C. Dickson.

Gifford, S. R. **Proliferating retinopathy in diabetes.** *Quarterly Bull. Northwestern Univ. Med. School*, 1943, v. 17, Winter Quarter, p. 252.

The contrast between ordinary diabetic retinopathy and proliferating diabetic retinopathy is pointed out. The author thinks the larger retinal veins are involved in the latter condition and that thrombosis of these veins may be the precipitating factor. The only case the author has seen from its onset was initiated by vitreous hemorrhages, followed by the usual blood-vessel and connective-tissue invasion of the vitreous.

In four cases out of six studied, increased capillary fragility was found. Cases with proliferating retinopathy are more likely to develop gangrene, and vice versa, showing that both have changes in the peripheral vessels. Gif-

ford points out the similarity between this condition and retinal periphlebitis. It is suggested that in all such cases careful study of the peripheral circulation be made, including pressor tests, heparin clearance, capillary fragility, and estimation of blood ascorbic-acid. The author concludes: "It is conceivable that if such tests were employed in every serious case of diabetes, the development of this tragic ocular condition might be prevented."

Robert N. Shaffer.

Gifford, S. R., Bauman, L., Jacobi, H. G., and Berens, C. **Symposium on diabetic retinitis.** *Amer. Jour. Digestive Dis.*, 1943, v. 10, Sept., pp. 329-339.

Gifford: In the largest group of retinal retinopathies the basic picture is of small round deep hemorrhages with small white discrete deposits in and about the central area. Frequently superimposed are fine flame-shaped hemorrhages in the nerve-fiber layer, usually due to associated vascular sclerosis. A second group of retinopathies is characterized by large, often preretinal, hemorrhages, usually followed by a variable new-vessel and connective-tissue formation. A third group presents retinal venous thrombosis.

Diabetic retinopathies are more frequent in older patients, and are not proportionate to the severity of the diabetes but to its duration. Ascorbic acid and vitamin-B complex do not improve the ocular condition because they do not cure the capillary fragility. Citrin, when available, should be tried.

Bauman: Hypertension is an aggravating factor in the production of diabetic retinopathies. Retinopathies are very frequently accompanied by gangrene and other foot complications of diabetes. Both result from sclerosis of the peripheral arteries with interference

of circulation, and both are largely preventable. Lack of restraint and coöperation is the principal cause of poor control in diabetes. Protamine zinc insulin alone or combined with ordinary insulin controls most patients. A new product, globin insulin, which apparently has the advantages of both, will soon be on the market.

Jacobi: Glycosuria and polyuria are harmful because they disturb the electrolyte balance. Too rigid diet restriction may be just as harmful as excessive laxity. A mild glycosuria may not be harmful in the elderly or arteriosclerotic diabetic, being a safety measure against insulin shock. Retinal lipemia and similar lesions are much less frequent with a low-fat régime.

Berens: No single ophthalmoscopic sign is pathognomonic of diabetes, although perimacular and other retinal changes are suggestive. Hypertension is apparently not the principal cause of retinal hemorrhages in diabetics. Bacteria and metabolic toxins may be factors. In patients with increased capillary fragility no improvement has followed the use of vitamin-B complex and ascorbic acid. Charles A. Bahn.

Leopold, I. H. Diabetic retinopathy. *Arch. of Ophth.*, 1944, v. 31, Jan., pp. 96-101.

This review of the literature discusses the etiology of diabetic retinopathy under the headings of hyperglycemia, vascular status, vitamin therapy, endocrine glands, and chemical constituents of the blood, especially fat.

Diabetic retinopathy has been variously attributed to uncontrolled hyperglycemia prior to administration of insulin (with the suggestion that the retinopathy is essentially a capillary disease).

Other special fields of study, here re-

viewed, include: dilatation of the retinal veins with production of punctate hemorrhages; experimental work as to the role of the endocrine glands in diabetes; and fat metabolism in relation to therapy. (Bibliography.)

R. D. Danielson.

Lewis, E. M. Angiomatosis retinae (successful treatment of one case). *Trans. Amer. Acad. Ophth. and Otolaryng.*, 1943, 47th mtg., May-June, pp. 354-363. (See *Amer. Jour. Ophth.*, 1943, v. 26, Dec., p. 1347.)

Lijo Pavia, J. Detachment; reattachment; tears and cyst of the retina. *Rev. Oto-Neuro. Oft.*, 1942, v. 17, Oct., pp. 107-117. (See *Amer. Jour. Ophth.*, 1943, v. 26, June, p. 644.)

Newton, F. H., and Schade, A. H. An experiment to determine the conservation of vitamin A in the eye under strain. *Ohio State Med. Jour.*, 1943, v. 39, Sept., p. 827.

The authors assume that night blindness is associated with vitamin-A deficiency and that soft tones on the walls of some industrial plants reduce eye fatigue. Six female employees whose work required very sustained and accurate fixation under artificial light were dark-adapted for two minutes, then subjected to a powerful light for two minutes, and then placed in the dark again, with a view to testing regeneration of the visual purple. Those who worked under a Verd-A ray lamp claimed to feel less fatigued than those who worked under a frosted lamp. In two cases with excessive eye fatigue, two hundred thousand units of vitamin A were given for a week. Less fatigue was then experienced, and the eyes felt more comfortable with a Verd-A lamp than with a frosted lamp. (Graphs.)

Charles A. Bahn.



Sal Lence, J. Specular pulsatile zones of the vitreous. *Arch. de la Soc. Oft. Hisp. Amer.*, 1942, v. 1, Oct., pp. 336-338.

With the aid of the Gullstrand ophthalmoscope, and examination of the eyes of more than 1,450 school children, the author has been able to observe brilliant reflexes in the fundus, especially along the veins. These reflexes are caused, according to the author, by internal reflection of the beam of light in the framework of the vitreous. Contrasted with the pulse of the retinal arteries, which is only present in certain pathologic conditions, the pulse of the reflexes described is a constant finding, especially in the eyes of young people; and its absence would indicate a pathological condition.

Ramón Castroviejo.

Wahrsinger, P. B. Severe pre-eclampsia with separation of the retina. *Amer. Jour. Obstet. and Gynecology*, 1943, v. 46, Oct., p. 371.

Appearance of retinal separation in severe pre-eclampsia is extremely infrequent but has been noted on several occasions. The author presents the following case: A 33-year-old woman, in her second pregnancy, was seen during the fourth month of gestation. All examinations were normal. The previous pregnancy had ended in spontaneous abortion. During the eighth month the patient was examined at home. She gave a history of nausea and vomiting of 24 hours duration, and an episode of temporary blindness. There was marked edema of face, conjunctivas, hands, legs, and ankles. The blood pressure was 195/110 mm. Upon hospital admission, urinalysis showed hyaline and granular casts. Sedatives, glucose, Karell diet, and Strognoff treatment were used. Ophthalmoscopic examina-

tion showed: right eye large retinal detachment in nasal half of fundus; small detachment below the optic nerve; left eye, large retinal detachment above and a small detachment below the optic nerve. The retinas and the margins of the optic nerves of both eyes were edematous, the margins of the discs blurred, the arteries narrowed. Retinal detachments and edema of the retina were probably due to subretinal and intraretinal transudates. The second day after Cesarean section, the edema of the retina subsided, but the detachments were of the same size. On the twelfth day post partum, the vision cleared and the blood pressure was 150/80 mm. Six weeks post partum, there was complete recovery from the retinal detachments. All findings were normal, the blood pressure 120/80 mm. The diagnosis was: severe pre-eclampsia with the retinal separation as a complication. Theodore M. Shapira.

## 11

### OPTIC NERVE AND TOXIC AMBLYOPIAS

Agatston, S. A. Congenital cyst of the optic nerve. *Amer. Jour. Ophth.*, 1944, v. 27, March, pp. 278-279. (2 illustrations, 1 in color, references.)

Anderson, W. A. Medullated nerve fibers. *Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, p. 343.

The fundi of a patient seen in 1943 at the age of 60 years, with normal vision, showed medullated fibers completely covering the edge of each disc. In September and October, 1940, the same patient presented himself with pain on movement of the left eye, reduced vision, optic neuritis, and some macular changes. The vision of the right eye remained normal. After re-

covery there was optic atrophy of the left eye, without light perception, and all of the medullated fibers had disappeared. The medullated fibers of the right eye remained as before.

Beulah Cushman.

Gottlieb, B. Retrobulbar and peripheral neuritis. *Rev. Oto-Neuro-Oft.*, 1942, v. 17, Sept., p. 183.

An alcoholic and chronic pipe-smoker exhibited classical symptoms of retrobulbar neuritis and peripheral neuritis of the upper and lower extremities. There was an associated achlorhydria. During treatment the patient was allowed to smoke, but alcohol was limited. He received orally high doses of vitamin-B complex and parenteral vitamin B<sub>1</sub>. After five weeks his vision was markedly improved, as was also the peripheral neuritis. Edward Saskin.

King, A. B. Tunnel vision. *Quarterly Jour. Studies on Alcohol*, 1943, v. 4, Dec., p. 362.

The term "tunnel vision" has been used to describe an effect of alcohol on the eyes. In the experiments of the author no tendency to blot out the sensitivity of the retina to visual stimuli at the periphery was found in five subjects who ingested 30 to 75 c.c. of absolute alcohol. The author concludes that "tunnel vision" is an inappropriate figure of speech. The reaction time of the eye in accommodating was found to be slowed. Robert N. Shaffer.

McGregor, I. S. A study of the histopathological changes in the retina and late changes in the visual field in acute methyl alcohol poisoning. *Brit. Jour. Ophth.*, 1943, v. 27, Dec., pp. 523-543.

The author reviews the literature concerning the ocular and general findings in methyl-alcohol poisoning, then

describes four acute cases. The retina was examined after routine staining with hematoxylin and eosin in bulk. No changes in the retinal ganglion cells could be attributed definitely to the acute poisoning by methyl alcohol, either in the form of lipoid changes in the ganglion cells, in the size and shape of the ganglion cells, or in nuclear content. The optic nerves in each case appeared normal.

Four patients who had been blind in the acute stage were examined a year later. One had no defect of vision, the second a bilateral scotoma, the third an absolute scotoma in one eye while the other eye was normal, and the last a relative scotoma in one eye with good vision in that eye and the other eye normal.

The author concludes that histologic examinations of the retina so soon after poisoning are rare, and that the evidences in acute poisoning are not sufficient to show whether it is the retinal tissue or the nerve tissue which primarily succumbs. The follow-up suggests that the poison acts on the center of the optic nerve. (7 illustrations, references.)

Beulah Cushman.

Mata López and Barthe Pastrana. A new case of Cruzon's disease. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1942, v. 1, Oct., pp. 329-335.

The authors report a new case of Cruzon's disease with the typical characteristics of oxycephaly, bilateral exophthalmos, divergent strabismus, diminution of vision, and facial deformities. The pathogenesis of this disease is discussed. In cases accompanied by progressive optic atrophy and diminution of vision, the authors advocate freeing the optic nerve at the optic foramen by the operation of Hildebran,

who has performed it with success in five cases. Ramón Castroviejo.

## 12

### VISUAL TRACTS AND CENTERS

Evans, J. N., and Browder, J. A problem of split macula. *Arch. of Ophth.*, 1944, v. 31, Jan., pp. 43-53; also *Trans. Amer. Ophth. Soc.*, 1943, v. 41.

The course and function of various fasciculi of the optic pathway have held the interest of ophthalmologists and neuro-anatomists for many generations, because knowledge in this field has a broad application to the diagnosis and treatment of ocular and cerebral disease. There are two general avenues of approach for studies of these fiber bundles. One may produce experimental lesions in various laboratory animals and study the resulting progress of fiber degeneration, or one may make functional studies on human beings who are suffering from certain localized lesions. Functional studies made on human subjects can be supported by anatomic evidence only when the injury or disease is observed at autopsy or operation. A review of the literature disclosed but two instances in which the optic chiasm had been split anteroposteriorly.

The major therapeutic problem that presents itself in attempted removal of a craniopharygioma is minimal injury to the hypothalamic nuclei and their connecting pathways. To this end three methods of surgical approach were utilized: first, removal of the tumor piecemeal, the optic apparatus being left intact; second, section of the one optic nerve in order to obtain a better exposure of that part of the tumor situated beneath the chiasm; third, splitting of the optic chiasm and division of the anterior communicating artery.

The authors report in detail the case of a 13-year-old boy with such a lesion. At operation the chiasm was divided with precision. The fields taken later showed classic bitemporal hemianopsia with a fingerlike absolute central scotoma which protruded from the blind field above the point fixed. The central scotoma could not cover the point fixed, since, macular function being impaired, the paramacular retina was used for this purpose. The true position of the macula was necessarily represented by some point within the fingerlike scotoma.

If the concept that the macular fibers form a semidecussation in the chiasm is adopted, then in the case cited the surgical procedure divided all the crossed macular fibers, with the result that the corresponding part of each macula was rendered functionless. This scotoma may then be assumed to represent the approximate size and shape of the part of the macula supplied by the crossed fibers.

The problem of fixation was of course encountered in the taking of the fields. A great many methods have been suggested for maintenance of fixation, but in this study the authors utilized the principle of the position and size of the normal blind spot and the adjacent angioscotoma. The use of these landmarks insures accurate fixation in normal subjects to within 0.25 degree. The authors conclude that the visual acuity resulting from division of the crossed macular fibers is approximately 20/40, which permits the subject to read and write such material as he is apt to need in average daily life. It is argued that the entire macula must be supplied by both crossed and uncrossed fibers. (References, 5 figures.)

R. W. Danielson.

Krug, E. F., and Echlin, F. A. **Tuberous sclerosis.** *Arch. of Ophth.*, 1944, v. 31, Jan., pp. 68-73; also *Trans. Amer. Ophth. Soc.*, 1943, v. 41.

A case of tuberous sclerosis is reported in detail in a young boy who was also afflicted with adenoma sebaceum. The cerebral tumor was removed by surgery with some loss of mental and physical powers. The visual acuity and visual fields were impaired and partial optic atrophy appeared. The term tuberous sclerosis was first used by Bourneville to describe a rare form of cerebral sclerosis occurring chiefly in children and young persons. Vogt, in 1908, established the clinical syndrome of mental deficiency, epilepsy, and adenoma sebaceum. Adenoma sebaceum, or nevus sebaceus, a disease of congenital origin, is characterized by pinhead-sized, yellow or reddish, waxy papules, situated on the flush areas of the face.

Tuberous sclerosis is so named, because of the potato-like appearance of the morbid growth. Neoplasms of this type may appear in the kidney, the heart, the lungs, the spleen, and the retina. Signs of intracranial tension are evident in early adult life, as epileptiform attacks. In the absence of such manifestations, a facial eruption should arrest the attention and suggest the presence of tuberous sclerosis, and concurrent papilledema at once suggests intracranial neoplasm. Associated retinal tumors are comparatively rare. (3 illustrations, references.)

R. W. Danielson.

Mello, A. R. de. **Hereditary degeneration.** *Arquivos Brasileiros de Med.*, 1943, v. 33, nos. 3-4 and 7-8, 90 pp. (Received in reprint.)

This ninety-page article reports in detail 16 cases studied in the neurologic clinic of Austregesilo, at Rio de Jan-

eiro. The literature is reviewed. No general conclusions are presented. Most of the patients belonged to familial groups, one family including six affected offspring. Some details of the eye condition are given in most of the cases, the predominating ocular feature being atrophy of the optic nerve, sometimes accompanied by other fundus lesions and sometimes by disturbances of the ocular muscles. (51 illustrations, separate bibliographies of the Brazilian and extra-Brazilian literature.)

W. H. Crisp.

Michaelson, I. C. **Ocular manifestations of neuroses found among soldiers.** *Brit. Med. Jour.*, 1943, Oct. 30, p. 538. (See Section 17, Systemic diseases and parasites.)

Stewart, S. G., Randall, G. C., and Riesenman, F. R. **Hysterical homonymous hemianopsia with hemiplegia and hemianesthesia.** *War Med.*, 1943, v. 4, Dec., p. 606.

A soldier suddenly developed partial left hemiplegia with homonymous "macula-sparing" hemianopsia, consistent with a diagnosis of an organic lesion of the brain on the right side. The clinical course, together with the objective neurologic observations, indicated a hysterical condition. Psychotherapy produced prompt and dramatic cure.

Robert N. Shaffer.

## 13

### EYEBALL AND ORBIT

Abbott, L. D., Mandeville, F. B., and Rein, W. J. **Complete roentgen and ophthalmologic examination for ochronosis in two alcaptonuric children.** *Virginia Med. Monthly*, 1943, v. 70, Dec., p. 615.

Two Negro children, aged 10 and 15

years, with alcaptonuria showed no positive roentgen evidence of joint change, ligament calcification, or calcium deposits in the ear cartilages. Ochronotic pigmentation of the scleras and conjunctivas was not definite, although alterations due to melanosis were found. Because of the racial pigmentation this was viewed as within normal limits but was carefully charted for later study. It is hoped that by follow-up the time of onset of definite changes due to alcaptonuria can be established. One author indicates that evidence of ochronosis may be found in the eyes as early as the third decade of life, although it is usually considered that the ochronosis is due to accumulation of pigment over a period of years and does not develop in alcaptonuria until middle age or later.

Owen C. Dickson.

Dimitry, T. J. The socket after enucleation and the artificial eye. *Arch. of Ophth.*, 1944, v. 31, Jan. pp. 18-28.

The author defines enucleation as the peeling of the eye from Tenon's capsule. He gives a résumé of the various procedures for removal of the eyeball. He insists that random severance of muscles and tissues to rid the orbit of the globe is not enucleation but extirpation. In discussing what happens to the remainder of the contents of the orbit after enucleation, Dimitry states that it is readily demonstrable clinically that improvement does not follow the sewing of opposing rectus muscles but that, on the contrary, disfigurement of the socket is produced. Some men do not even sew the wound, and yet get excellent results.

Various modifications such as implants have been devised in an effort to obtain a mobile stump. Dimitry believes we accomplish the mobile stump

but have been unsuccessful in obtaining the mobile prosthesis. He is of the opinion that the plastic prosthesis will largely solve the problem of a movable prosthesis. He criticizes the ophthalmologist for turning the responsibility of the fitting over to a nonmedical technician. (8 figures, references.)

R. W. Danielson.

Ulluer, L. J. Orbital cellulitis. *Rev. Oto-Neuro-Oft.*, 1942, v. 17, Aug., pp. 143-145.

The author considers orbital cellulitis an acute inflammation of the soft tissues of the orbit, characterized by bulbar congestion, lid edema and ptosis, limitation of ocular motility, chemosis, and a septic fever. He believes that the chief cause of orbital cellulitis is acute nasal-sinus infection (70 to 80 percent of all cases), the pathway being the sinus veins, thence into the superior and inferior ophthalmic veins. Swimmer's sinusitis and the acute exanthemata of childhood are frequent offenders.

Pathologically, orbital cellulitis may result in an orbital phlegmon or abscess, a subperiosteal abscess, or a thrombophlebitis with cavernous-sinus involvement. This latter must be differentiated early from orbital cellulitis. Treatment should be directed toward the infected sinuses (if they exist) drainage of the orbit, and chemotherapy.

Edward Saskin.

## 14

### EYELIDS AND LACRIMAL APPARATUS

Jiménez González, R. A new operative procedure for senile ectropion. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1942, v. 1, Oct., pp. 339-344.

The method consists in the excision of a triangular piece of tarsus and muscle of the conjunctival aspect of

the lower lid. The base of the triangle is directed toward the fornix. A doubly-armed suture is inserted through the conjunctiva near the lateral incisions close to the base of the triangle, and the two ends of the doubly-armed suture, threaded on one needle, are then passed through the conjunctiva below the base of the triangle and brought out on the skin at about the center of the lower orbital margin. The threads are tied in this position, pulling them to the extent necessary to correct the ectropion. In subsequent dressings the position of the lid may be controlled by loosening or tightening the suture. (5 illustrations.)

Ramón Castroviejo.

Lemere, H. B. A vacuum device for the eyelids. *Arch. of Ophth.*, 1944, v. 31, Jan., p. 95.

Expression of the meibomian glands by digital pressure or by some form of spatula, while not very painful, is occasionally objected to by the patient. In a situation of this kind, the author attached the glass portion of a medicine dropper to the tubing of the suction apparatus used for nasal displacement treatment. He found that passage of the end of the dropper back and forth along the margin of the lids tended to evacuate accumulated material from both the meibomian glands and the hair follicles.

He has found this procedure a valuable adjuvant to treatment in practically all his cases of chronic and in some cases of acute conjunctivitis. He instills a drop of 0.5-percent solution of pontocaine hydrochloride a minute before using the suction, and two drops of a 1 to 500 solution of silver nitrate afterward to take care of any floating material resulting from the suction.

R. W. Danielson.

Rosen, Emanuel. A case of acute metastatic dacryoadenitis. *Amer. Jour. Ophth.*, 1944, v. 27, March, pp. 276-278.

Thomas, Maxwell. Management of chalazia. *Texas State Jour. Med.*, 1943, v. 39, Oct., p. 347.

Thomas shows a diagrammatic sketch of incisions for removal of chalazion. He discusses the etiology, diagnosis, and treatment and describes the procedure for thorough removal. Management of chalazia requires a knowledge of the anatomy of the lids, with a true conception of the pathologic process. Theodore M. Shapira.

## 15

### TUMORS

Black, G. W. Melanotic sarcoma of the iris. *Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, pp. 304-306.

Sarcoma of the iris furnishes 2 to 6 percent of the malignant tumors of the uveal tract. The author reports a case in a woman 64 years of age. A brown patch on the left iris which had been noticed for 40 years became slightly larger, with flattening of the pupillary margin. The mass was removed by iridectomy through a keratome incision and covered by a conjunctival flap. The pathologic report showed an early spindle-cell type of melanotic sarcoma, the peripheral portion intensely pigmented, corresponding to the brown patch. At the pupillary margin the tumor mass was highly cellular and contained scanty pigment.

Beulah Cushman.

Black, G. W. Reticulum-cell sarcoma. *Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, pp. 316-317.

A plum-colored tumor attached to the outer surface of the external rectus

muscle by fibrous trabeculae was removed. On microscopic examination the bulk of the tumor consisted of large closely packed cells with rounded or oval vesicular nuclei and ill-defined cytoplasm as of reticulum cells. The arrangement was diffuse, with a fair number of mitotic figures. There was moderate infiltration by lymphocytes but no lymph follicles.

Beulah Cushman.

Burch, F. E., and Camp, W. E. **Results of irradiation of malignant melanomas of the uveal tract.** *Trans. Amer. Acad. Ophth. and Otolaryng.*, 1943, 47th mtg., May-June, pp. 335-352.

Even intensive irradiation of the eye is valueless in any of the types of malignant melanoma. Roentgen therapy does not assure against metastasis; there is even a possibility that metastases develop earlier after irradiation than when it is not employed. Irradiation should be reserved for cases in which only the tumor-containing eye retains vision, for cases in which the patient refuses enucleation, and those in which the orbit and adjacent structures are already invaded. (4 tables.)

Gertrude S. Hausmann.

Hollander, L., and Krugh, F. J. **Cancer of the eyelid.** *Amer. Jour. Ophth.*, 1944, v. 27, March, pp. 244-253. (22 figures.)

## 16

### INJURIES

Allen, T. D. **Industrial ophthalmology.** *Surg. Clinics North America*, 1942, v. 22, Aug., pp. 1011-1028. (See Section 18, Hygiene, sociology, education, and history.)

Berens, C., and McAlpine, P. T. **Solar keratoconjunctivitis associated**

**with amblyopia.** *Amer. Jour. Ophth.*, 1944, v. 27, March, pp. 227-231. (6 fields, references.)

Dickson, R. M. **First-aid treatment of industrial eye injuries.** *Brit. Jour. Ophth.*, 1943, v. 27, Dec., pp. 544-548.

The author records the results after six months trial of the use of 10-percent sodium-sulphacetamide solution as first-aid treatment in eye injuries in 30 mines and 30 factories. Of the total injuries in 30 mines in Scotland, 96 percent returned to work with no loss of working time. In the shipyards 98.87 percent of the patients lost no working time. (References.)

Beulah Cushman.

Gundersen, T., and Liebman, S. D. **Effect of local anesthetics on regeneration of corneal epithelium.** *Arch. of Ophth.*, 1944, v. 31, Jan., pp. 29-33.

Clinically it has been observed from time to time that local anesthetics have an inhibitory influence on the regeneration of corneal epithelium. In this investigation, the corneas of guinea pigs were abraded and measurements were made of length of time required for regeneration of the corneal epithelium when various anesthetics were used hourly during healing. The drugs used were solutions of 10-percent cocaine hydrochloride, 4-percent cocaine hydrochloride, 1-percent butacaine sulfate, 4-percent larocaine hydrochloride, 1-percent phenacaine hydrochloride, and 0.5-percent tetracaine hydrochloride. All solutions contained 0.5-percent chlorobutanol.

Both 10- and 4-percent cocaine very definitely retarded the regeneration of epithelium; more retardation was observed with the stronger solution. In fact, repeated instillations on the intact epithelium produced corneal areas



which stained with fluorescein. The inhibitory effect of cocaine diminished as increasingly hypertonic solutions were used. Tetracaine gave similar results, although less pronounced. The delayed healing of the epithelium was observed in varying degrees with 1-percent phenacaine, 1-percent butacaine sulfate, and 4-percent larocaine. One percent phenacaine and 0.5-percent tetracaine were the least toxic. The pH is probably not a determining factor, since buffered solutions at a pH comparable to that of the anesthetics used showed relatively little inhibitory action. Two very descriptive charts are included. (References.)

R. W. Danielson.

Hughes, W. F. **Management of injuries to the eyes.** Surg. Clinics North America, 1942, v. 22, Oct., pp. 1355-1373.

The author writes especially in regard to war injuries. The article is essentially a résumé of the diagnosis and treatment of various injuries, including lacerations, fractures of the bones of the orbit, intracorneal foreign bodies, perforating injuries, concussion injuries to the eye, and burns, especially those due to war gases. (References.)

R. C. Richardson.

Jaime, G. G. **Cephalic tetanus of ocular origin.** Rev. Oto-Neuro-Oft., 1942, v. 17, Jan.-Feb., pp. 22-26; March-April, pp. 52-58; May-June, pp. 88-94.

Cephalic tetanus, or tetanus limited to the region of the head, follows facial injury (orbit, nose, temporal, or malar regions). There is an incubation period of at least one week, after which the typical unilateral or bilateral trismus occurs, followed later by facial paralysis. This paralysis is of the peripheral type, and the muscles involved need

not be near the site of injury. Occasionally, the above symptoms are preceded by an ophthalmoplegia manifested by ptosis. Other eye signs noted are miosis and fixed pupils. The author cites several cases of cephalic tetanus following ocular injury, such as perforation of the cornea associated with loss of the eye. The affection is relatively rare. Etiologically, the offending organism is Nicolaïer's bacillus, *Clostridium tetani*, found in the infected wound in or around the lids, orbit, or the eyeball. The author claims conclusive proof that the organism is Nicolaïer's bacillus, and that there is an associated virulent toxin. He offers a mechanical theory of the pathogenesis by which the toxin causes a direct nerve irritation. A reflex theory of the pathogenesis involves the trigeminus as the conducting pathway of the toxin, which latter affects the facial nerve and the third, fourth, or sixth nerves. A third, directly infectious theory claims a toxic or bacterial invasion of the body fluids from the infected wound. The author states that whatever theory is finally accepted the passage of the organism or toxin is centripetal, backward from the wound.

The author discusses his studies of diagnosis, course, prognosis, symptomatic and specific treatment, active and passive immunization, preventive serotherapy, therapeutic serotherapy, and anaphylaxis. The diagnosis is simple, given an infected wound about or of the eye, an incubation period, then facial trismus or paralysis. The course may be acute, subacute, or chronic, lasting as little as two days and ending in death, or becoming protracted with a more satisfactory outcome. The prognosis is usually guarded, even in the protracted cases. There may be residual paralysis or paresis if death does

not intervene. The treatment is symptomatic, as in generalized tetanus. Specific antitoxin is administered in addition. The author's active immunization is similar to our vaccination with an attenuated toxin; passive immunization is specific. He also discusses using blood serum from well individuals previously stricken, as well as intravenous, intra-arterial, and intracranial administration of the antitoxin, always being on the watch for hypersensitivity.

Edward Saskin.

Kirby, D. B., and Town, A. E. Injuries of the eyes and eyelids. *Surg. Clinics North America*, 1943, v. 23, April, pp. 404-438.

The authors present a comprehensive discussion and review of the prevention, diagnosis, and treatment of ocular injuries of all kinds. The usual treatment of traumatic lesions and burns is covered, as well as later surgical treatment—plastic surgery—to remedy defects. (10 illustrations, references.)

R. C. Richardson.

Mann, Ida. A study of epithelial regeneration in the living eye. *Brit. Jour. Ophth.*, 1944, v. 28, Jan., pp. 26-39.

Experimental study of epithelial regeneration in the eyes of rabbits showed formation of pigment in the basal cells of the conjunctival or corneal epithelium. The pigment allowed recognition of the particular cells involved, and their migration could be followed from day to day with the loupe or slitlamp. The initial loss of epithelium was confirmed by the use of fluoresceine, and the observations originally made on rabbits were confirmed clinically in man. The injuries were produced by scraping, chemicals and heat, without damage to the underlying tissues.

The first series of experiments demonstrated the movement of the pigmented epithelium in an irregular line which met the slide of epithelium from the opposite side in less than 20 hours. The pigment from these advanced cells gradually disappeared as the cells were replaced, and the original pigment line, which had become thinner, gradually assumed its original density. The area of spread from the activating substance seemed to be more than 2.5 mm. and less than 5 mm. from the edges of the wound in all directions. If the injury was produced by a hot wire the movement of the pigment epithelium was much less, was very irregular, and did not occur all around the burned area, the heat having evidently destroyed the activating substance. If the conjunctiva was injured near the cornea, the pigmented cells slid toward the area as though the wound were in the cornea.

A second series of experiments involved injury to larger areas of the cornea by various chemicals. Healing of the superficial loss was usually complete within four days, whereas the pathologic process continued its course beneath the epithelium for days or weeks. If the whole width of the ring had migrated, the gap in the limbal pigment never completely regenerated.

A third series of experiments dealt with production of pigment proliferation in response to chemical injury by the arsenical war gases. In this type of injury the proliferation did not occur until after healing of the epithelium, but it was progressive and continued to increase for months.

A fourth series of experiments dealt with pigment migration in vitamin-A deficiency. It could be produced experimentally in rabbits without epithelial loss, and was based upon a wandering of chromatophores.

The experiments corroborate the general agreement that epithelium heals by migration from the edge of the denuded area, associated with mitosis at some distance from the defect. Thus the loss is made good by pre-existent cells which move actively across to cover the raw zone, and these cells are replaced by cell division behind their original positions and not over the wound area. (14 illustrations, references.)  
Beulah Cushman.

Moore, P. G. Management of magnetic foreign bodies in the eye. *Ohio State Med. Jour.*, 1944, v. 40, Jan., p. 26.

An adequate headrest, oblique illumination, a loupe with a half-inch focal distance, and a sharp Graefe knife are stressed by the author as necessary for proper removal of corneal foreign bodies. Distinction between the dead white ring of coagulated tissue surrounding a hot foreign body and the gray of an infected infiltrate is important. The author uses a 1 to 500 zinc sulphate solution as routine antiseptic. He feels that bandaging of eyes following removal of obviously uninfected foreign bodies is not indicated if the corneal surface is not denuded. Infection, shown by the appearance of a gray ring on the second day, requires wiping out the wound with a stronger antiseptic such as 3.5-percent iodine or trichloroacetic acid.

Management, indications for anterior or posterior approach, and postoperative care of patients with intraocular magnetic foreign bodies are also discussed. Indications for enucleation are enumerated, with the emphasis on conservatism unless the eye is unquestionably blind and irritable or painful.

Owen C. Dickson.

Pierse, Dermot. A case of removal of nonmagnetic foreign body from the ciliary region. *Brit. Jour. Ophth.*, 1943, v. 27, Dec., pp. 550-552.

In a man 38 years of age a small piece of brass perforated the cornea and was visible in the angle of the anterior chamber. The vision was 6/9, the lens clear, and no abnormality was seen in the fundus. There was no response to the giant magnet, and the fragment disappeared backward upon the attempt to grasp it through a corneal incision. It was then localized accurately on an X-ray film with the aid of a needle inserted in the sclera. The approach was made 4.0 mm. from the limbus, using a hinged flap of sclera. The ciliary body was investigated with the point of the knife until the foreign body was felt, when it was easily removed through the ciliary body. The scleral flap was closed with a previously inserted suture, and the conjunctiva replaced. Two weeks later the vision with -0.75 cyl. axis 175° was 6/6. (References.)

Beulah Cushman.

Robson, J. M. Experimental corneal ulcers. *Brit. Jour. Ophth.*, 1944, v. 28, Jan., pp. 15-25. (See Section 6, Cornea and sclera.)

Rosen, Emanuel. An interesting case of rupture of the choroid. *Brit. Jour. Ophth.*, 1943, v. 27, Dec., pp. 552-554.

The author reports two cases with rupture of the choroid in the macular area, one with resulting corrected vision of 20/20 and the other of 8/200. He concludes that the distinct anatomy of the macula modifies the traumatic pathology. (2 illustrations.)

Beulah Cushman.

## SYSTEMIC DISEASES AND PARASITES

Carmichael, F. A. *Migraine, a review*. Jour. Kansas Med. Soc., 1943, v. 44, Oct., p. 333.

The basic mechanisms mentioned are: pressure on cranial and upper cervical nerves, traction on or spasm of the basilar vessels, traction or reduced caliber of venous sinuses, and inflammation in or about pain-sensitive structures. Causation involves many apparently unconnected details which, however, can be resolved into three fundamental elements combined in varying proportions. The first is the hereditary factor, which is known to exist in 70 percent of migraine sufferers and which includes a predisposition to this syndrome in some parts of the brain and of the autonomic nervous mechanism. The chemical details of these changes are not yet known, but those afflicted frequently also have other neuroses especially involving the vasomotor mechanism. The second factor is that of age, 80 percent of migraine beginning between the ages of eight and ten years, somewhat before puberty. Most women sufferers are relieved by the menopause, and in some the attacks are influenced by menstruation. The third or environmental factor includes physical and chemical conditions of many kinds which intensify or retard the hereditary predisposition, thus altering the minimal time between attacks as well as their severity. Among those mentioned are histamine sensitiveness, the environmental factors which aggravate hypertension, compression of the fifth nerve, and a small calcarine tumor whose removal was curative. Migraine, however, is apparently less frequent in patients with

liver or biliary tract disease, the reason being as yet unknown.

In the treatment two drugs are emphasized: ergotamine tartrate, a vasoconstrictor, and potassium thiocyanate, a vasodilator. The former should not be used in patients with anginal symptoms and other evidence of obliterative vascular disease. The latter is apparently better adapted for migraine sufferers with hypertension.

Charles A. Bahn.

Garcia Miranda, A. *Avitaminosis in ophthalmology*. Arch. de la Soc. Oft. Hisp.-Amer., 1942, v. 1, Oct., pp. 344-377. (See Section 2, Therapeutics and operations.)

Greenberg, M. M. *The ocular manifestations of multiple sclerosis*. Dis. Eye, Ear, Nose, and Throat, 1942, v. 2, Oct., p. 296.

A comprehensive summary is given of the history, symptoms, course, etiology, and treatment of multiple sclerosis, with detailed attention to the ocular manifestations.

Robert N. Shaffer.

Harris, Wilfred. *Ataxic nystagmus. A pathognomonic sign in disseminated sclerosis*. Brit. Jour. Ophth., 1944, v. 28, Jan., pp. 40-42. (See Section 4, Ocular movements.)

Lloyd, R. I. *Less evident causes of lowered acuity in senility*. Amer. Jour. Ophth., 1944, v. 27, March, pp. 232-243; also Trans. Amer. Ophth. Soc., 1943, v. 41. (13 illustrations, references.)

Michaelson, I. C. *Ocular manifestations of neuroses found among soldiers*. Brit. Med. Jour., 1943, Oct. 30, p. 538.

This report deals with the ocular manifestations of hysteria and of the

chronic anxiety state, these being the two most common neuroses. In hysteria, the most common symptoms are diplopia and defective day or night vision.

Of the anxiety states, asthenopia, headache, photophobia, muscae volitantes, and epiphora are more common. The authors point out the importance of evaluating functional and organic components in each case. In any of the more severe cases the help of a psychiatrist is needed to effect the profound personality change necessary for permanent removal of the underlying cause of the patient's symptoms.

Robert N. Shaffer.

Murphy, R. C., Jr. An eruptive fever involving the mouth and eyes (Stevens-Johnson disease). *New England Jour. Med.*, 1944, v. 230, Jan. 20, p. 69.

About twenty cases characterized by acute and at times fulminating systemic reactions with fever, prostration, generalized skin rash, and severe stomatitis followed by sloughing with eventual recovery have been reported. A mucopurulent type of conjunctivitis is noted almost constantly. No etiologic agent has been discovered. Panophthalmitis has occurred with loss of the eyes in several patients. This may be due to secondary conjunctival invasion by staphylococcus aureus as suggested by recovery of this organism in the present reported case. Previously reported cases ran from 22 months to 16 years, the great majority being in males.

The present case is that of a 22-year-old Italian male. At onset the disease appeared as a tenderness of the buccal mucosa, with rapid appearance of tight whitish vesicles surrounded by erythema, which proceeded to rupture and slough. Temperature between the third

and sixth days varied around 104.6 F. No vesicles appeared on the conjunctivas, although they were diffusely inflamed and a mucopurulent discharge was present. The temperature fell on the eighth day. Similar lesions (vesicles) appeared on the extremities and on the glans penis and corona. Crusting of the lesions had occurred by the seventeenth day, and before the end of the fourth week the scars were barely visible.

This is thought to be a definite clinical entity, although etiologic relation to Vincent's stomatitis is not confirmed. The description used for these cases has been "erythema multiforme bullosum with involvement of the mucous membrane of the eyes and mouth."

Owen C. Dickson.

Negus, V. E. The relationship of ophthalmology and rhinology. *Brit. Jour. Ophth.*, 1943, v. 27, Dec., pp. 554-557.

The author urges that in many conditions about the nose and eyes the rhinologist and ophthalmologist should work together. He suggests that the label "orbital cellulitis" is often misleading, these being really cases of frontal sinusitis and acute ethmoiditis with orbital edema. They should be treated with lavage of the maxillary sinus, which is usually infected, and with an ephedrine spray.

The author has seldom found iridocyclitis due to suppuration of the nasal sinuses, although infected tonsils were often causative factors. Desensitization and medical treatment of nasal allergy often improved a concurrent conjunctivitis.

Beulah Cushman.

Thygeson, Phillips. Virus diseases of the eye. *Trans. Pacific Coast Oto-Ophth. Soc.*, 1942, v. 27, pp. 58-102.

The material covered by this article is very similar, although somewhat more briefly stated, to that published in the Archives of Ophthalmology, 1943, v. 29, Feb., p. 285; March, p. 488; and April, p. 635. (See abstracts, Amer. Jour. Ophth., 1943, v. 26, June, p. 666; and Aug., p. 892.)

Woods, A. C. Syphilis of the eye. Amer. Jour. Syph., Gonorrhea, and Ven. Dis., 1943, v. 27, March, p. 133.

This long and valuable survey of the subject includes consideration of the various stages of congenital and acquired syphilis respectively, with a statement of the lesions which prevail in each period of either form of the disease. Consideration is given to the type of treatment suitable for each combination. Particularly valuable sections are those dealing with neuro-ocular lesions of late meningovascular neurosyphilis, and with degenerative neurologic lesions. Three basic types of optic-nerve atrophy are discussed, with the corresponding visual fields. Type one, representing 12 percent of these cases, progresses from the periphery into the center, and has concentric visual fields and late loss of vision. Type two (34 percent of the cases) progresses from the pia in the form of a wedge, involves sectors of the optic nerve, and has sector-shaped fields and either early or late loss of vision. Type three (54 percent of the cases) progresses as a generalized degeneration, and has cecocentral scotomas, either with or without peripheral field defects, and with early loss of vision. We are reminded that vitamin-A and B deficiencies may be contributory or aggravating factors. Subdural treatment with arsphenaminized serum is said to reduce blindness to 50 per-

cent at the end of nine years but is occasionally responsible for sudden extinction of what vision is present. For malaria and other forms of fever therapy it is claimed that only 14 percent of the patients are blind at the end of nine years. Charles A. Bahn.

Yudkin, A. M. Nutrition as it affects the eye. Med. Clinics of North Amer., 1943, v. 27, March, pp. 553-560.

Brief consideration is given to ocular disturbances on a background of nutritional deficiency, with special mention of night blindness, conjunctivitis and blepharitis, chorioretinitis, and vitamin therapy. The author also discusses secondary ophthalmic disorders which are regarded as sometimes responding to treatment with vitamins, such disorders including marginal ulcers of the cornea, early stages of cataract, hemorrhagic retinitis, and toxic amblyopia from alcohol and tobacco. (References.)

W. H. Crisp.

## 18

### HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Allen, T. D. Industrial ophthalmology. Surg. Clinics North America, 1942, v. 22, Aug., pp. 1011-1028.

Allen discusses industrial ophthalmology from the standpoint of the general surgeon, rather than from the standpoint of the ophthalmologist. The importance of preemployment and periodic eye examination is considered, as well as that of good lighting in industry. There is mention of the treatment of minor eye injuries, as well as of the treatment of more serious injuries such as retinal detachment, intraocular foreign body, and ocular burns. (7 illustrations.) R. C. Richardson.

Beach, S. J. The American Board of Ophthalmology learns about written examinations. *Med. Clinics of North America*, 1943, pp. 1409-1415. (See *Amer. Jour. Ophth.*, 1943, v. 26, Sept., p. 911.)

Birren, F. Color technique in industry. *Sight-Saving Review*, 1943, v. 13, May, p. 3.

Selection of colors in industry must be directed at minimizing work hazards and ocular fatigue. Rest rooms, lunch rooms, and so on, should feature soft, cheerful colors—as blue and rose. In work rooms, ceilings and upper walls should be white or bright blue; floors, a light color reflecting about 25 percent; and lower walls and machinery, a soft gray color reflecting 25 to 40 percent—thus giving the fixated part of the field the same illumination as the adjacent parts.

In general, yellow (not red) should be used for critical hazards; yellow-green or orange for lesser hazards; and red reserved for fire escapes, exits, and the like.

Benjamin Milder.

An eye health program for schools. *Sight-Saving Review*, 1943, v. 13, May, p. 22.

The minimum recommended intensity of illumination for close work at school should be 15 foot-candles, in diffuse, glare-free illumination. Natural illumination should be provided through windows occupying space at least equivalent to 16 percent of the area of the floor, situated to the left of the pupils. Walls should be of light color, with dull finish. Seating should be so arranged that the desks are turned at a 30° angle away from the windows. (The authors do not seem to give any attention to the question of

the teacher's position in relation to the light, or of reflections from the blackboard.) Printed matter should be 10-point for children over twelve years old, increasing to 24-point or 30-point for children under seven years.

Education of teachers is important in an eye health program, with emphasis on special attention to those children requiring it. The testing of visual function must be undertaken in school. Cooperation between parents, school, and medical profession will produce the best results. Education of child, parents, and the community is the final, all-important objective of an eye health program for schools.

Benjamin Milder.

Gruber, K. F. The vocational training program for the visually handicapped in the Minneapolis public schools. *Sight-Saving Review*, 1943, v. 13, no. 2, p. 104.

Before the establishment of a vocational-training program the visually handicapped were graduated from the Minneapolis public schools with purely academic skills. The present plan permits 12th-grade students in the sight-saving classes to spend part of their time in selected industries earning credits to be applied toward graduation.

Careful studies of aptitude of individual pupils are made through cooperation of an ophthalmologist, a psychologist, and the school, including a coöordinator between school and industry. The family background is studied; intelligence and aptitude tests are given; recommendations are made. The student chooses the training plan which interests him most.

In the industry the pupils are carefully supervised. Every effort is made to make them compete on even terms



with nonhandicapped workers. In the school, effort is made to coach the pupils in qualities, such as punctuality, courtesy, independence, and personal appearance, which will aid them in obtaining employment.

Robert N. Shaffer.

Kuhn, H. S. **Significance of visual defects in war production effort.** *Jour. Amer. Med. Assoc.*, 1943, v. 123, Dec. 25, p. 1085.

The consulting ophthalmologist working with industries must supervise with extreme vigilance the entire industrial program; treatment of eye injuries, eye-protection plans, job standard evaluations, and rehabilitation procedures. Physicians should not hesitate to offer their services to industries. (One figure, 2 tables, discussion.)

George H. Stine.

Landa Lion, Luiz. **Ophthalmology of high altitude.** *Arquivos Brasileiros de Oft.*, 1943, v. 6, Aug., pp. 141-143.

A special ophthalmology of high altitude exists by reason of the special meteorological, climatic, and racial conditions. The author finds in the South American altiplano a people with special characteristics, religious, artistic, and physical. These people have large thorax and slight development of the lower extremities. Their physiologic attributes include hypotension and polyglobulia. A semianesthetic condition of the tissues arises from the chewing of coca by 70 percent of the population. Glaucoma is rare, and the author speaks of this fact as supporting the interpretation of that disease as a local manifestation of a general condition. Pterygium is frequent in Bolivia as compared with other countries, and is interpreted by the writer as a mechanism of defence against the constant ac-

tion of the winds occurring in that region. In La Paz trachoma is unknown, and the trachoma patients of Argentina visit that city for relief from their disease. It is said that, on account of the chewing of coca, the Bolivian ophthalmologist, when operating upon the eye, does not have to concern himself greatly with the question of anesthesia.

W. H. Crisp.

Lester, Eileen. **Opportunities for the visually handicapped through job analysis.** *Sight-saving Review*, 1943, v. 13, May, p. 29.

The visually handicapped may fall in this category by virtue of low corrected visual acuity, impairment of visual field, progressive ocular disease, various degrees of color blindness, muscular imbalance, or impairment of stereopsis.

Industrial surveys indicate that the vast majority of large concerns make no effort at job analysis in regard to visual requirements; a majority make an inadequate visual test, or none at all; and very few have any program for conservation of sight.

It is essential to undertake thorough job analysis to determine what jobs can be performed by persons with visual limitations. It is equally important to provide a full and adequate program of examination of all job applicants, including the visually handicapped, with an estimate of how the individual can best use whatever visual abilities he has.

Benjamin Milder.

Mann, Ida. **The scope of prevention in ophthalmology.** *Brit. Med. Jour.*, 1943, Oct. 16, p. 482.

The existence in England and Wales of 74,000 blind persons whose support costs the state 4½ million pounds yearly emphasizes the importance of planned prevention of blindness. Re-

duction of the incidence of eye diseases could come from three ways: (1) Improving the services of the oculist, by making modern ophthalmic-hospital treatment available to everyone, by standardizing the system of training ophthalmologists and requiring a uniform standard of examination, by close supervision and better facilities for diagnosis and treatment of children under school age and of adolescents leaving school. (2) Educating the public. Some biologic and physiologic instruction in schools should be obligatory, including the mechanism of sight, the errors of refraction, and presbyopia. The industrial worker should be instructed in methods of protecting the eyes. (3) Establishment of research teams (in association with laboratories) in which physicists, biochemists, physiologists, and pathologists among others could unite with ophthalmologists for solving given problems.

R. Grunfeld.

Martin, H. G. **Fads and fallacies regarding our eyes.** *Milwaukee Med. Times*, 1943, v. 16, Nov., pp. 15-19.

As 80 percent of our intellectual development is acquired through visual processes, and as our eyes were not intended by nature to be used as we use them, the symptoms of ocular discomfort are frequent. The author does not, however, discuss in detail just how to avoid the misuse of the eyes. Ocular conditions stand first or second on all lists as causes of rejection for the armed forces. Clear sight develops at the end of the first year and binocular vision about the fourth year. The author believes that faulty ocular habits during this time produce symptoms later in life, and that many children's eyes are not given a chance to develop normally. Such exercises to strengthen

the eyes as are now in vogue have had periods of favor during the past hundred years, Rolling the eyes in different directions, as popularly practiced, exercises strong and weak muscles equally, and therefore can accomplish no good.

Charles A. Bahn.

Morgan, D. H. **Vocational aptitudes of the visually handicapped.** *Outlook for the Blind*, 1943, May, p. 125.

Advanced vocational training for the blind and partially blind is discussed. Examples of successful candidates from the California School for the Blind for placement in the shops of the public high schools are described. A program for handling the visually handicapped is offered, with special suggestions on how to overcome the discouraging attitude of principals of public high schools.

Francis M. Crage.

Prado, Durval. **Contribution to the history of optics in São Paulo.** *Arquivos Brasileiros de Oft.*, 1943, v. 6, Aug., pp. 124-127.

The history of optics in São Paulo, Brazil, dates back about a half century. The first of three phases was purely commercial. Most of the glasses were of French origin and took the form of pince-nez. At that time, only sufferers from external disorders of the eyes made free use of smoked or blue glasses. The choice of glasses depended entirely at best upon a short reading at the time of purchase, the person's age serving as the main criterion for determining the proper "number." Systematic borrowing of glasses among the less fortunate was frequent. The glasses were graded by numbers in inches. They were sold at stores for surgical supplies, musical articles, clocks, and so on.

The first attempt at an optical work-

shop appeared about 1895, the grinding being done on a stone wheel moved by a pedal managed by the operator. Up to that time São Paulo had not possessed physician oculists properly so called. The few prescriptions which appeared had to do with presbyopia or simple myopia.

Beginning with 1902 the scientific phase of optics in São Paulo appeared with the settlement there of a number of physician oculists, foreign and Brazilian, almost all of whom had had special courses in Europe. Up to 1912 prescriptions for myopia predominated, although Pignatari began in 1902 the prescription of cylindrical lenses and the notation in diopters. The cylinders were usually prescribed at horizontal or vertical axes. But some prescriptions showed axes between 30 and 60 degrees. Beginning with 1912, the newly founded School of Medicine and Surgery in São Paulo taught ophthalmology as a true specialty. The laws of Brazil have not yet recognized a profession of optometry. W. H. Crisp.

Suhey1 Unver. Remarks concerning the history of Turkish ophthalmology. *Göz Klinigi*, 1943, v. 1, Aug., p. 16.

In the Orient ophthalmology was practiced as a specialty for many centuries, especially in Turkey. The ophthalmologist was called "Kehhal," which is Arabic and originally meant "cosmetic for the eye." Reference is made to many old textbooks and monographs about eye diseases, generally written in the Arabic language, but some of them in Turkish. The most famous authors were Ali Ibni Isa Elmedujisi (ninth century) and Ibni Sina (Avicenna, 980-1037 A.D.). Centuries ago an eye doctor was attached to each hospital. J. Igersheimer.

Vaughan, M. S. Public health nursing in a trachoma control program. *Sight-Saving Review*, 1943, v. 13, no. 2, p. 91.

The author summarizes the methods and difficulties of establishing a trachoma-control clinic in Arkansas, organizational structure and efforts to educate both personnel and public being outlined. She sums up her article by saying that "the public-health nurse's services in a trachoma-control program are essentially the same as in any other public-health program for control of communicable disease."

Robert N. Shaffer.

Weiss, Charles. The geographical distribution of ocular infections. *Amer. Jour. Ophth.*, 1944, v. 27, Feb., pp. 175-177. (One table, references.)

## 19

### ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Stone, L. S. Return of vision in transplanted adult salamander eyes after several days of refrigeration. *Proc. Soc. Exper. Biol. and Med.*, 1943, v. 34, Oct., p. 44. (See Section 13, Eyeball and orbit.)

Stone, L. S., and Dinnean, F. L. Lens induction in the salamander (*amblyostoma punctatum*) with special reference to conditions in experimentally produced cyclopia. *Yale Jour. Biol. and Med.*, 1943, v. 16, Oct., p. 31.

In a series of experiments the authors show that the lens in *amblyostoma punctatum* arises in the surface ectoderm by induction of the eye-forming center at a definitely circumscribed period in its development. If this center is absent, no lens is produced. Defects

produced in the prechordal substrate by immersion in lithium-chloride solution or by surgical means gave rise to cyclopia and other malformation. This

emphasizes that conditions in the lens are always subservient to the dominance of the eye-forming centers.

Robert N. Shaffer.

## PAN-AMERICAN NOTES

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Communications should reach the Editor by the twelfth of the month

### MISCELLANEOUS

*Argentina.* Under the direction of Prof. Baudilio Courtis the Section of Ophthalmology of the "Patronato Nacional de Ciegos" has been entirely reorganized. This institution for the blind opened, one year ago, a modern dispensary called "Consultorio Central—'Pedro Lagleyze'" in honor of Professor Lagleyze, one of the most famous oculists of Buenos Aires. The building of the Patronato was erected by private contributions amounting to \$150,000. It is a large structure of modern architecture, has four floors, and is provided with complete appliances for the diagnosis and treatment of eye diseases.

*Brazil.* In July of 1943, a decree was signed instituting the compulsory use of Crêde's method in the State of Bahia.

### JOURNALS

*Anales de la Sociedad Mexicana de Oftalmologia y Oto-Rino-Laringologia.* This journal contains the following articles dealing with ophthalmologic subjects: July and August, 1942, Dr. José Saenz Canales: "Cystic formations in the vitreous, a clinical case"; September-October, 1942, Dr. M. de Rivas Cherif: "Bio-photo-micrography of the eye—A preliminary note"; November and December, 1942, Dr. Paul A. Chavira: "Treatment of penetrating injuries of the anterior segment of the eye"; May-August, 1943, Dr. Paul Gonzáles Enríquez: "Optochiasmatic meningitis," with a commentary by Dr. Manuel Marquez; and September-December, 1943, Dr. Robert Fitzpatrick: "Mydriasis and the different drugs to produce it."

### SOCIETIES

*Argentina.* At the third monthly meeting, held in May, 1943, The Argentinian Ophthalmological Society awarded its annual prize for "the best paper read" to Drs. Flaminio Vidal and Jorge Malbran for their essay on "Disposition of myelin fibers in the chiasma of a cat." (Experimental study.)

The Ophthalmological Society of the Litoral

in Rosario, Argentina, elected the following officers to serve during 1942-1944: President, Prof. Carlos Weskamp; General Secretary, Prof. Adj. Dr. Juan Manuel Vila Ortiz; Treasurer, Prof. Adj. Dr. Roberto E. Giqueaus; Members: Prof. Adj. Dr. Isaac Cottlier, Dr. Luis A. Gallo, Dr. Salvador Imbern, and Dr. Juan Maggi Zavalia.

*II Pan-American Congress of Ophthalmology.* The Uruguayan Committee in charge of the organization of the Congress, taking into account the world situation, feels that the meeting should be postponed until November 3, 1944. The scientific program remains unchanged, one day being given to each of the following four sections; as follows:

Social Ophthalmology: Official papers prepared by the Committees on Prevention of Blindness and Trachoma of the Pan-American Congress of Ophthalmology.

Research Papers—Medical Ophthalmology: Four papers on glaucoma have been chosen for this section as follows: "The pre-glaucomatous state—Its diagnosis and treatment." "New ideas on glaucoma derived from gonioscopy." "Estimation and mechanism of the destructive effects of ocular hypertension." "Surgical intervention in glaucoma—How far can medical treatment be continued?"

Surgical Ophthalmology: "Surgical treatment of paralytic strabismus." "Surgical treatment of heterophorias." "Surgical treatment of heterotropias."

Free Papers.

*Chile:* The Chilean Committee of the Pan-American Congress of Ophthalmology has elected the following officers: President, Prof. Carlos Charlin; Vice-Presidents, Prof. C. Espildora Luque, Prof. I. Martini, and Dr. S. Barrenechea who is the Chilean Delegate to the Council of the Congress; Treasurer, Dr. Ida Thierry; Secretary, Prof. J. Vardaguer; Members of the Committee, Drs. A. Schweitzer, R. Costa, and R. Contardo. Dr. J. Thierry is the president of the Valparaíso Committee and the members of this committee are Drs. Tuyll Kuhlman, and A. Robert. The Chilean Com-

mittee has already sent a list of subscribers to the Pan-American Congress of Ophthalmology to the executive secretary, Dr. Conrad Berens.

*A new society* of the Fellows of the Kellogg Foundation—Pan-American Congress of Ophthalmology. On October 13, 1943, at a meeting in Chicago at which were present Drs. Bertha R. Noble, Daniel Silva, and Eduardo Barduño, from Mexico; Manoel da Silva from Brazil; Carlos H. Candray from El Salvador; Juan A. Diaz, from the Dominican Republic; Gustavo Vasquez from Paraguay and Augustin Peret from Venezuela, Fellows of the Kellogg Foundation Pan-American Congress of Ophthalmology, it was decided to found a Society which will promote a greater understanding between the Kellogg Fellows and develop cultural and social exchange between the ophthalmologists of the Americas. Dr. Harry S. Gradle was nominated honorary president in recognition of his work in Pan-American ophthalmology. A committee composed of Drs. Daniel Silva, Augustin Peret, and Manoel da Silva was elected to organize the Society and to draw up the statutes.

#### PERSONALS

At an extraordinary public meeting on July 29th, Dr. Romulo Gil was received as a member of the Argentine National Academy of Medicine. Dr. Gil will take the place of Dr. Noceti, deceased.

The Moura Brasil Prize for 1943 was won by Dr. Sylvio de Abreu Fialho of Rio de Janeiro, with a paper on "Contribution to the problem of the diagnosis of early glaucoma."

The following is a list of the doctors who are already in the United States studying at selected clinics as beneficiaries of the Kellogg Foundation—Pan-American Congress of Ophthalmology Fellowships: *Brazil*: Dr. Manoel Antonio da Silva of São Paulo, at the Illinois Eye and Ear Infirmary, Chicago; Dr. Heitor da Costa Pinto Marbach of Bahia, at The Johns Hopkins Hospital, Baltimore; Dr. Geraldo Queiroga of Minas Geraes, at the University of Iowa, Iowa City. *Chile*: Dr. Michel Mehech Haddad of Santiago at the Mayo Clinic, Rochester, Minnesota. *Costa Rica*: Dr. Alvaro Montero Padilla of San José at Cook County Hospital, Chicago. *The Dominican Republic*: Dr. Juan Antonio Diaz Espinal, of Ciudad Trujillo, at Wills Hospital, Philadelphia. *El Salvador*: Dr. Carlos Candray of San Vicente, at the Massachusetts Eye and Ear Infirmary, Boston. *Haiti*: Dr. Joseph Roger Malebranche of Cap-Haitien, at New York University, New York City. *Honduras*: Dr. Efraín Ochos Reina

of Comayagua, at the Memphis Eye, Ear, Nose and Throat Hospital, Memphis, *Mexico*: Dr. Eduardo Garduño Ballesteros of Villa Obregón, at the New York Eye and Ear Infirmary, New York City; Dr. Daniel Silva Lopez Hermosa of Mexico City, at Northwestern University, Chicago; Dr. Bertha Riveroll Noble of Mexico City, at Tulane University, New Orleans. *Paraguay*: Dr. Gustavo Adolfo Vazquez of Asunción, at Columbia University, New York City. *Peru*: Dr. Enrique Samuel Haro of Lima, at the Stanford Lane Hospital, San Francisco. *Puerto Rico*: Dr. Mariano Cecil Caballero of San Juan, at the New York Eye and Ear Infirmary, New York City. *Venezuela*: Dr. Agustín Perret-Gentil of Caracas, at the Illinois Eye and Ear Infirmary, Chicago.

Two have already completed their Fellowships and returned to their homes. These are: Dr. Alexander W. Arathoon of Guatemala, who had a Fellowship at the Massachusetts Eye and Ear Infirmary, and Dr. Francisco de Almeida Rosa of São Paulo, Brazil, who studied at the University of Michigan and the New York Eye and Ear Infirmary.

Drs. Andreine Campanella and Maria C. de Carvalho have been appointed by the Institute of Inter-American Affairs to take an ophthalmologic course at the Washington University, St. Louis, Mo.

During the last two weeks of November, Prof. Moacyr E. Alvaro, executive secretary of the Pan-American Congress of Ophthalmology, visited the Argentine and Uruguay. In Buenos Aires, Dr. Alvaro was invited by Dr. Malbran, president of the Argentine Society of Ophthalmology, to preside at the annual meeting of that Society, where Dr. Sená read a paper on "Sulfonamides in ophthalmology." At the Alvear Hospital, at the invitation of Dr. Belgeri, Dr. Alvaro lectured on "How can the ophthalmologist cooperate with the general practitioner in order to obtain a correct diagnosis?" and at the Rawson Hospital at the invitation of Dr. Carlos Damel, head of the Ophthalmological Department of that hospital, Dr. Alvaro gave another lecture on "The advantages of organized ophthalmology." Dr. Alvaro took the opportunity offered by this trip to visit the above-mentioned ophthalmologic services and was also invited to visit the Patronato Nacional de Ciegos under the direction of Dr. B. Courtis, the Santa Lucia Hospital directed by Ibañez Puiggari, the chair of ophthalmology of the Faculty of Medicine of the University of Buenos Aires, directed by Prof. Raul Argañaraz, and the Fernandez Hospital under the direction of Dr. Juan Gallino.

Dr. Alvaro together with Prof. E. B. Demaria visited the eye clinics of the chair of

ophthalmology of the Faculty of Medicine of La Plata, of Rosario, and of Cordoba. In the latter he was received at the local Ophthalmological Society.

In Montevideo, Dr. Alvaro presided at a meeting of the Committee for the Prevention of Blindness of which Prof. Vasquez Barriere is president.

Dr. Juan Verdaguer, Chief of Clinic in the service of Professor Charlin (Santiago de Chile), was appointed Extraordinary Professor of Ophthalmology in the Medical School of the University of Chile. His incorporation thesis dealt with "Detachment of the retina and its treatment."

Dr. M. Uribe Troncoso received an invitation to read a paper at the annual meeting of the Pan-American Medical Association, Washington chapter, and give a lecture on "Gonioscopy, Its development and clinical applications." The meeting was held on March 18,

1944, at the Mexican Embassy, under the presidency of the Ambassador, Dr. F. Castello Nájera, honorary president of the chapter. On the same day Dr. Troncoso was guest of honor at a luncheon at the International Medical Club of Washington, D.C.

#### OBITUARY

Dr. Enrique L. Graue, a well-known ophthalmologist in Mexico City, and a former director of the Ophthalmic Hospital of Nuestra Señora de la Luz, died in May, 1943, at the age of 72 years. He was born in Mexico City in 1871. After his graduation, in 1897, he traveled extensively in Europe, attending the London clinics and Paris ophthalmic institutions. He was a fine surgeon and a very charitable man, attending the poor patients in the city and in his hospital with devoted care. He was a member of the Mexican Society of Ophthalmology and Otolaryngology. His oldest son, who has the same name, is also an eye specialist and practices in Mexico City.

# NEWS ITEMS

Edited by DR. DONALD J. LYLE

904 Carew Tower, Cincinnati 2

News items should reach the editor by the twelfth of the month.

## DEATHS

Dr. Milton R. Barker, Wilmette, Illinois, died February 3, 1944, aged 92 years.

Dr. Edgar Bates, Ogden, Utah, died January 24, 1944, aged 74 years.

Dr. Arthur E. Jessup, Diagonal, Iowa, died January 12, 1944, aged 74 years.

Dr. Waldo N. Lemmon, Hereford, Texas, died January 1, 1944, aged 71 years.

Dr. Frederick M. Spalding, Boston, Massachusetts, died January 24, 1944, aged 73 years.

Dr. Henry R. Slack, LaGrange, Georgia, died January 16, 1944, aged 81 years.

Dr. Roy W. Dunlap, Tulsa, Oklahoma, died January 29, 1944, aged 65 years.

Dr. Halbert H. Acker, Anderson, South Carolina, died January 20, 1944, aged 56 years.

Dr. Horace L. Goodman, Ronceverte, West Virginia, died February 28, 1944, aged 67 years.

Dr. Charles Graef, New York, New York, died February 27, 1944, aged 72 years.

Dr. Arthur C. Haney, Russellville, Arkansas, died December 22, 1943, aged 54 years.

Dr. Frank L. Secoy, Sioux City, Iowa, died January 23, 1944, aged 57 years.

Dr. Daniel H. Bell, Tacoma, Washington, died recently, aged 72 years.

Dr. Joseph W. Ehmer, Crivitz, Wisconsin, died recently, aged 77 years.

Dr. Arthur E. Falkenbury, Whitehall, New York, died January 23, 1944, aged 78 years.

Dr. William J. Holton, Plant City, Florida, died January 7, 1944, aged 60 years.

Dr. Joseph L. Wicks, Evanston, Wyoming, died January 31, 1944, aged 73 years.

Dr. John W. Dean, Glens Falls, New York, died December 18, 1943, aged 75 years.

Dr. Erra D. Stump, Charleston, West Virginia, died March 1, 1944, aged 59 years.

## MISCELLANEOUS

The next examination by the American Orthoptic Council will be held in September-October, 1944. The written examinations will be held at various cities in the country on September 7, 1944. Only those passing the written examinations will be permitted to take the oral and practical tests, to be given in Chicago, October 7, 1944. Applications on official forms must be received before August 1, 1944. Address the American Orthoptic Council, 23 East 79th Street, New York 21, New York.

The twelfth semi-annual postgraduate course in "Neuromuscular anomalies of the eyes"

will be given at the Children's Memorial Hospital, Chicago, Illinois, by Dr. George P. Guibor, May 7-12, 1944.

As an addition to the growing number of motion pictures in the field of health education a two-reel film, "Eyes for tomorrow," was produced for the National Society for the Prevention of Blindness, 1790 Broadway, New York City. "Eyes for tomorrow" stresses good general health as a prerequisite for good eyesight, besides dealing with the importance of conservation of vision among school children, methods of treatment of glaucoma and trachoma, importance of prenatal care as a means of reducing blindness caused by syphilis and gonorrhea, and the eye hazards of industry. The film, in 16 and 35 mm., will be distributed in the United States by the National Society for the Prevention of Blindness. Prints in 16 mm. are offered for sale at \$50.00, or rental at \$5.00 per day, exclusive of time in transit.

The American Board of Ophthalmology has announced that examinations will be held in New York on June 2d, 3d, and 5th, and in Chicago on October 5th to 7th. The new address of the Board is 704 Congress Street, Portland, Maine.

The Association for Research in Ophthalmology, Inc., announces its program for the fourteenth scientific meeting, to be held on Tuesday, June 13, 1944, at the Hotel Sherman, Chicago, Illinois.

1. Choline esters with mydriatic and cycloplegic action. Kenneth C. Swan, M.D., and Norman G. White, M.S., University Hospital, Iowa City, Iowa.

2. The dissociation of form and light perception in amblyopia ex anopsia. Hermann M. Burian, M.D., and George Wald, Ph.D., Biological Laboratories of Harvard University.

3. A quantitative test for measuring degree of red-green color deficiency. Louise L. Sloan, Ph.D., AAF School of Aviation Medicine, Randolph Field, Texas.

4. A study of the pathogenicity of diphtheroid bacilli isolated from the human conjunctivae. Charles Weiss, M.D., Isabella H. Perry, M.D., and Marion C. Shevsky, A.B., Mt. Zion Hospital, San Francisco, California.

5. Backflow phenomena in aqueous veins of normal and of glaucomatous eyes. K. W. Ascher, M.D., Department of Ophthalmology,



College of Medicine, University of Cincinnati.

6. Effect of chemotherapeutic agents on cell division of the intact and regenerating corneal epithelium following burns and abrasions in the rat. George K. Smelser, M.D., and V. Ozanics, M.D., Columbia University College of Physicians and Surgeons, New York.

7. Evaluation of the use of penicillin in military ophthalmology. John G. Bellows, Major (M.C.), Billings General Hospital, Fort Benjamin Harrison, Indiana.

Frederick C. Cordes, Chairman  
Brittain F. Payne, Major (M.C.)  
Secretary (Program)  
Conrad Berens  
Acting-Secretary-Treasurer

#### SOCIETIES

The annual congress of the Ophthalmological Society of Egypt was held at the Memorial Ophthalmic Laboratory, Giza, Egypt, on March 15th and 16th. The program consisted of a symposium on "Ulcers of the cornea."

The Florida Medical Association held its seventy-first annual meeting at Saint Petersburg on April 13th and 14th. Among the speakers was Dr. Walter I. Lillie, Philadelphia, who lectured on "Fundus changes in arterial hypertension." Included in the specialty groups which

met during the session was the Florida Society of Ophthalmology and Otolaryngology.

At the annual session of the South Carolina Medical Association Dr. Roderick MacDonald, Rock Hill, presented a paper on "Headache from an eye, ear, nose, and throat standpoint."

The Brooklyn Ophthalmological Society held its regular meeting on April 20th. The scientific program consisted of the following papers: "The pathology of congenital hydrophthalmos and allied conditions" by Drs. Bernard Samuels and Edward Burchell, and "Surgical treatment of congenital glaucoma," by Dr. John H. Dunnington.

#### PERSONALS

The Warren Triennial Prize of \$500, presented by the Massachusetts General Hospital, was awarded to Dr. David G. Cogan, Dr. V. Everett Kinsey, and Mr. Erwin O. Hirsch, of the Howe Laboratory of Ophthalmology, Harvard Medical School, for the essay "Physiological studies on the cornea."

The University of Minnesota Medical School, Minneapolis, has appointed Dr. Erling W. Hansen, former clinical assistant professor of ophthalmology, to the position of clinical professor and director of the division of ophthalmology at the university.

# AMERICAN JOURNAL OF OPHTHALMOLOGY

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## THE EXOPHTHALMOS OF HYPERTHYROIDISM

A DIFFERENTIATION IN THE MECHANISM, PATHOLOGY, SYMPTOMATOLOGY, AND  
TREATMENT OF TWO VARIETIES\*

## Part I

JOHN H. MULVANY, F.R.F.P. & S.GLAS., F.R.C.S.ENG.,  
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London

## INTRODUCTION

It is hoped that this paper dealing with the differentiation of the exophthalmos of hyperthyroidism into two varieties will prove of some interest to those concerned in its study. Particularly worthy of consideration is the corollary implied in the possible existence of the distinction; namely, the inference that each variety of proptosis constitutes merely one important feature of two unrelated and separate diseases hitherto included under a number of terms in the literature although mostly being confused with thyrotoxicosis.<sup>†</sup> The general application of the latter term to all and sundry forms of hyperthyroidism is partly responsible for the anomaly as the practice tends to obscure the apparent circumstance that, while all varieties of thyrotoxicosis are hyperthyroid, not all instances of hyperthyroidism are examples of thyrotoxicosis. Elsewhere it has been pointed out (Mulvany, 1943) that the various forms of hyperthyroidism occurring spontaneously in man fall into three main categories, thyrotrophic, thyrotoxic, and thy-

ropathic. The first, depending upon pituitary control, is familiar as a physiologic and pathologic occurrence in the latter third of pregnancy and in acromegaly, respectively. The second is exemplified in exophthalmic goiter, a compound expression of hyperthyroidism and sympatheticonia maintained apparently independently of thyrotrophic activity; and the last, arising from local disease of the thyroid gland, is often seen, usually in a transient form, in the early phases of neoplasm or infection or in lymphadenoid goiter. It is expedient for an improved understanding of the problems connected with hyperthyroidism that its composite pathogenesis should be appreciated.

Of these several varieties of hyperthyroidism, two only appear generally to be associated with exophthalmos; namely, thyrotoxicosis proper and one form of thyrotrophic origin. The latter results from increased thyrotrophic activity; but the absence of exophthalmos in pregnancy and acromegaly makes it evident that thyrotrophism *per se* does not lead to proptosis. There is evidence to suggest

\* This paper was accepted May, 1938, by the Royal College of Surgeons for the purpose of a Hunterian lecture delivered in February, 1939. A few additional remarks relating to more recent observations have been included.

<sup>†</sup> The term thyrotoxicosis is used in this paper synonymously with Basedow's disease, Graves's disease, exophthalmic goiter, and diffuse, toxic, or hyperplastic parenchymatous goiter.

that another factor, the coöperation of certain sterones, is also essential for the development of exophthalmos in experimental thyrotrophic hyperthyroidism, and it may be assumed on reasonable grounds that the equivalent disorder occurring spontaneously in man possesses a similar pathogenesis. Should this assumption prove correct, the process indicates probably a disturbance of thyroid and sex secretions, as sex function is greatly influenced by certain types of steric activity; but further work is required to elucidate this problem. The present paper, however, is not concerned with the general considerations of pathogenesis but will deal only with the differentiation of the proptosis occurring in this disorder from that associated with exophthalmic goiter.

#### HISTORICAL NOTE

It is well over 100 years since the attention of the medical profession was directed for the first time to the problem of exophthalmos occurring in association with an enlargement of the thyroid gland. The credit for this discovery is often ascribed to Basedow (1840), although it has been established that the condition was described some years earlier by Parry (1776) and Graves (1835). The anomaly may be explained possibly on the ground that the account given by Basedow was the fullest in point of original observation, particularly in connection with the exophthalmos. Nevertheless, the discoveries of these three observers were independently made and all are therefore deserving of an appreciation by posterity; although, as Osler has remarked, the account left by Parry was so complete and original that it more justly entitles him to the honor of the discovery of exophthalmic goiter than does that of the others.

Be that as it may, the first published explanation of the mechanism thought to be responsible for the development of the

exophthalmos came from the pen of Basedow. This feature, so pronounced in one of his cases that both eyes were lost, was considered by him to be produced by a "strumous hypertrophy" of the retrobulbar cellular tissues, not due to edema or fat, but possibly similar in nature to the morbid process responsible for the association of those peculiar swellings known as areas of "localized myxedema." This interesting observation, based apparently on clinical surmise, was not supported by pathologic evidence, and today it is well known that examination of the orbit at autopsy in the typical case of Graves's disease discloses no indication of increased retrobulbar pressure. The remark, however, is of special interest in view of the recent revival of the theory of *proptusio bulbi a tergo* occasioned by reports of a progressive type of exophthalmos, associated in about half the cases with hyperthyroidism, in which the proptosis has been due unquestionably to increased intraorbital pressure. The majority of these cases have been labelled exophthalmic goiter, but numerous other diagnoses, ranging from idiopathic aseptic thrombosis of the cavernous sinus to polyglandular disturbance, and from exophthalmic ophthalmoplegia to idiopathic myositis of the extraocular muscles, have been attached. These varied opinions are in contrast to the singleness of the pathologic and clinical features which in their uniformity contribute strong support for believing the condition to be distinct from exophthalmic goiter.

Following the pioneer work on the subject, the growth of knowledge and interest progressed smoothly. Shortly after the publication of Basedow's famous article, there appeared a report by Cooper (1849) containing an explanation of the mechanism which produced exophthalmos. The suggestion was that the proptosis depended upon two factors; namely, an ab-

sence of the proper tonicity of the muscles which served to retain the eyes in their natural position in the orbit, and the presence of venous congestion of the retrobulbar cushion confined to the tissues therein and not extending to the eyes. As with Basedow's idea, the theory is of interest because it appears certain that weakness of the voluntary eye muscles plays an essential part in the development of proptosis in exophthalmic goiter; and, indeed, if the presence and function of the unstriated musculature of the orbit had been known in Cooper's day, it is not unlikely that the mystery of the mechanism would have then been solved.

#### ROLE OF UNSTRIPED ORBITAL MUSCULATURE

The experiments of Claude Bernard (1858), in which retraction of the lids and proptosis in rabbits were noted to follow stimulation of the distal cervical sympathetic nerve, and the publication by Müller (1858) of the anatomic work on the smooth muscle of the orbit gave a further stimulus to thought on the subject. Aran (1860) put forward the view that the proptosis of Graves's disease was produced by a contraction of the unstriated orbital muscle, an idea at first received with enthusiasm until it became known that stimulation of the cervical sympathetic in man did not cause exophthalmos although lid retraction and dilatation of the pupil were evident. Thus, Jaboulay (1898), Jonnesco (1897), and more recently Pochin (1939) convinced themselves on this point by practical experiment in the course of operations on the neck, and Müller (1861) and Wagner (1859) arrived at a similar conclusion by using the heads of newly decapitated criminals.

The first experiments on a more scientific basis intended to solve the problem were carried out by MacCullum and Cor-

nell (1904). These investigators exposed the orbit of the dog and found that this animal possessed a well-developed periorbital membrane which extended forward in the shape of a cone from the region of the optic foramen to the margins of the orbit. They demonstrated that this membrane contained a large amount of unstriated muscle and that protrusion of the globe followed stimulation of the cervical sympathetic which induced a wave of peristalsis to pass along the cone. Transverse section of the cone led the peristalsis to cease at the edge of the sectioned area and prevented the development of a proptosis. Similar experiments have been conducted by Code and Essex (1935) who confirmed the findings of MacCullum and Cornell and demonstrated also the presence of a rise of pressure within the fascial cone during the period of stimulation.

MacCullum and Cornell formed the opinion that "although no certain conclusions could be drawn from their work, the possibilities were perhaps more closely defined." It seemed, however, that there was a failure to appreciate the anatomic differences between the orbits of man and the dog, which are of such a type as to preclude the application of a common mechanism to both. In the dog, sheep, and certain other animals, the periorbital membrane forms a well-developed muscular structure characterized by a strength and mobility not present in man. The reason for this distinction lies in the fact that the bony socket in these animals is rudimentary, being formed by bone only on its inner wall, so that a strong periorbital membrane is essential. Hence it is not a difficult matter for a contraction of this powerful and mobile structure to give rise to proptosis. In the ape and man, however, the position is quite different, as the presence of a regular bony socket obviates the need for an additional muscular support.

In them, the periorbital muscular elements are vestigial and rendered still less effective in contraction by a close attachment to the orbital walls, a point confirmed by the fact that stimulation of the cervical sympathetic nerve in the ape, as in man, does not lead to protrusion of the globe. On this account it is safe to assume that the periorbital smooth muscle plays no significant part in the development of proptosis in exophthalmic goiter.

Thus it was that the unsatisfactory nature of the anatomic basis of the theory built around Müller's periorbital muscle led to a more thorough examination of the orbit, and in 1907 Landström was able to demonstrate by means of serial sections in three planes the presence of smooth muscle in the anterior half of the orbit. This took the form of a cuff surrounding the front half of the globe, being attached anteriorly to the back of the orbital septum and extending backward to the region of the equator of the eye, where it was inserted into fascial expansions given off by the recti muscles at their point of attachment to the globe. As a result of these investigations, Landström was able to state that this muscular cuff could by its contraction exert traction on the globe, and he ascribed the exophthalmos of Graves's disease to this factor. The theory, however, although anatomically sound, still failed to explain why stimulation of the cervical sympathetic in man does not produce proptosis.

It was evident, therefore, that some other factor was required to supplement the action of the orbital unstriated musculature, and in 1935 Plummer and Wilder demonstrated its nature. In a closely reasoned article, these observers were able to establish in exophthalmic goiter the existence of a positive correlation between the amount of myasthenia and the degree of exophthalmos present. They expressed the opinion that it would be possible for a

spastic contraction of Müller's orbital muscle to produce exophthalmos in the presence of weakened recti muscles. Some criticism of this view is justifiable from the fact that Müller's orbital (better termed periorbital) muscle is hardly capable of influencing the position of the eye in any circumstances, but there is no reason why Müller's palpebral muscles and Landström's muscular cuff could not achieve this in the presence of a weakened voluntary musculature within the orbit. This aspect of the problem will be considered again later in connection with the discussion of the actual mechanism concerned in the production of the proptosis.

#### THE ROLE OF THE THYROTROPIC HORMONE

While these theories concerning the part played by the unstriated musculature of the orbit were being developed, there began to appear in the literature reports of cases of progressive bilateral exophthalmos associated with peculiar pathologic changes in the voluntary ocular muscles. About half the cases were stated to have been accompanied by thyrotoxicosis, but in the others this was not noted or else its association was doubtful. The first of these cases to give rise to general interest was described by Foster Moore (1920). The patient, a woman aged 53 years, had a severe proptosis which resisted lid-suture and was still urgently in need of further treatment. The author thereupon exposed the orbit through the lower fornix and removed as much as a heaped-up teaspoonful of edematous fat, after which it became possible to approximate the lids. He noted that the recti muscles, instead of being thin flat ribbon-like structures were "greatly swollen fusiform bellies not quite so stout as the last joint of one's little finger." It was obvious that in this particular case the proptosis was due to retrobulbar pressure,

and the author concluded, in view of the unusual features, that a modification of this process was the probable mechanism responsible for its appearance in Graves's disease. The histologic examination of a portion of the inferior-oblique muscle, removed at the time, disclosed the presence of a certain type of morbid change which in recent years has become more familiar mainly through the writings of Burch (1929) and Naffziger (1933) and which has been associated clinically with a progressive and severe type of exophthalmos, often complicated by corneal ulceration and allied phenomena. A peculiar and common feature in many of these cases was that the condition had apparently been induced or accentuated by the performance of a thyroidectomy for the relief of hyperthyroidism, an aim successfully achieved.

Some light was shed on these events by the work of Schockaert (1932), of Loeb and Friedman (1932), and of Marine and Rosen (1933) who showed that hyperthyroidism with exophthalmos could be produced by an injection of pituitary extract containing thyrotrophic hormone. Naturally, the idea grew that the pituitary gland might be responsible, if not for Graves's disease, at least for the development of the exophthalmos. A great deal of work in this direction has been done without settling the problem, but the view relating to the pituitary genesis of the disease has gained strength. Nevertheless, caution is required in the acceptance of the hypophyseal theory, as there is strong evidence against it with little or nothing conclusively or incontrovertibly in its favor; so that the possibility of thyrotoxicosis being governed by some factor other than the thyrotrophic hormone should be borne in mind.

The most important contributions in support of the pituitary genesis of thyrotoxicosis are probably those of Smelser

(1937) and Marine (1938). The former was able to examine the orbital tissues in certain patients thought to have Graves's disease and to compare the pathologic changes therein with those he had observed experimentally in the orbits of guinea pigs treated with thyrotrophic hormone. The results of his observations were sufficiently conclusive to enable him to say that the experimental type, with certain minor differences, closely resembled the clinical variety. The tissue response, including the muscle hypertrophy and edema of the connective tissue, was general and included the characteristic round-cell infiltration which has come to be recognized as an essential part of the pathologic picture. Further, Smelser stated that edematous infiltration of the retrobulbar tissues had been repeatedly demonstrated in, and presented as, the cause of exophthalmos associated with Graves's disease; a statement requiring modification, as the vast majority of orbital examinations at autopsy fail to reveal any such causative factor. However, as Smelser remarked, exophthalmos has been found with all ranges of basal metabolic rate and particularly extreme cases of the progressive variety have followed thyroidectomy when the basal metabolism was subnormal. The conclusion therefore drawn by this observer was that the mechanism of exophthalmos in hyperthyroidism and hypothyroidism was the same, although the thought that cases activated by a different mechanism, possibly sympathetic excitation, might exist.

Similar views are held by Marine (1938) who claimed that thyroid insufficiency, either relative or absolute, is one of two essential factors underlying the development of the exophthalmos in Graves's disease; by Brain (1938) who stated that in exophthalmic goiter the exophthalmos is not the result of hyperthyroidism, and more recently by Eden



and Trotter (1942) who concluded that the exophthalmos occurring in diffuse toxic goiter is extrathyroid in origin. Such views, so contrary to what is generally accepted in relation to the proptosis of exophthalmic goiter, depend to a certain extent on an idea that hyperthyroidism is a single entity; on a failure to perceive that all varieties of hyperthyroidism not being instances of thyrotoxicosis, the accompanying proptosis may not be consistently uniform in etiology; on lack of consideration that thyrotoxicosis, being fundamentally a hyperthyroid disease, the associated exophthalmos equally must be thyrotoxic in nature; and lastly on a faulty interpretation of the fact that while a certain variety of thyrotrophism may lead to hyperthyroidism and exophthalmos, the latter depends on the presence of the thyrotrophic hormone and not of the thyroid gland—hence its appearance with all ranges of basal metabolism. The true position is that the exophthalmos of hyperthyroidism may be either thyrotoxic or thyrotrophic, but the progressive proptosis of hypothyroidism can be only hypophyseal in origin.

The work of Marine is of great importance and enlightenment. In 1932, this observer, working in conjunction with others, noticed that exophthalmos associated with goiter developed in certain pubertal rabbits fed on a diet of alfalfa hay and oats or after a daily injection of 0.1 c.c. of methyl cyanide. The fact that the exophthalmos did not develop until large parenchymatous goiters had appeared and that such goiters were associated with hypertrophy of the pituitary body of the type seen after a thyroidectomy suggested there was a close relationship between thyroid deficiency and increased activity of the anterior pituitary and between the latter and the appearance of the proptosis. Indeed, in the above experiments and in guinea pigs treated with

injections of anterior pituitary extract, removal of the thyroid gland was found to facilitate the development of the exophthalmos, a phenomenon capable of explanation on the ground that the injection process is supplemented by the stimulus to increased pituitary output induced by the operation.

Another highly important observation made by Marine was that a greater degree of exophthalmos appeared in those animals which were most active sexually. This prompted him to investigate the effects of cryptorchidism and gonadectomy on the development of the exophthalmos. His results showed that while cryptorchidism had no effect, gonadectomy caused a regression of the proptosis when present or prevented its appearance in others. Injection of the androgens, particularly of testosterone, effectively replaced the missing orchids but the estrogens were inert. These findings led him to conclude that the degree of functional activity of the interstitial cells of the testes was an important factor in determining the development of the exophthalmos and to formulate the view that "thyroid insufficiency (relative or absolute) and anterior pituitary hyperactivity appear to be two of the essential factors underlying the development of the exophthalmos of Graves's disease . . . and that an increase in the functional activity of the interstitial cells and possibly of the adrenal cortex is necessary." The apparent paradox in the statement follows the practice of accepting an experimental pituitary hyperthyroidism as being the equivalent of Graves's disease. It is quite certain that thyroid insufficiency is not a feature of thyrotoxicosis and that the degree of exophthalmos often bears some relation to the height of the metabolic rate. It may be recalled also that there is no evidence of pituitary overactivity in Graves's disease, the gland

often being small and sometimes atrophied, and the adrenal cortex may be degenerated and the gonads relatively inactive. Marine's remarks, however, can well be applied to the experimental variety of gonadothyrotrophism and his observations concerning the activity of the adrenal cortex become of special interest because it is possible that this structure may form the source of the essential sterone in women after the menopausal atrophy of the gonads.

Nevertheless, Marine's experiments are highly important because for the first time an explanation is offered to account for the absence of exophthalmos in the other varieties of thyrotrophic hyperthyroidism. As noted earlier, acromegaly and pregnancy are only very rarely accompanied by exophthalmos although the basal metabolism may be raised as much as 50 percent by thyrotrophic stimulation of the thyroid gland. In certain instances of myxedema, also, there is an increased amount of thyrotrophic hormone in the bloodstream, yet exophthalmos remains notably absent. It is patent, therefore, that the thyrotrophic hormone is only partly responsible for the development of the proptosis, and that some additional factor is also essential. The work of Marine affords grounds for believing this to consist of certain of the androgens. It is probable that the hyperthyroidism and exophthalmos induced by injections of anterior pituitary extract (which however purified contains gonadotrophin as well as thyrotrophin) are the outcome of an experimental gonadothyrotrophism and not of a simple thyrotrophism; and it is not unlikely that the equivalent state in man possesses a somewhat similar pathogenesis. Hyperthyroidism, a feature both of exophthalmic goiter and thyrotrophic exophthalmos, is relieved in each instance by a thyroidectomy; but the effect of the operation on the exophthalmos is differ-

ent in the two diseases. In the first, the proptosis is relieved or not altered; in the second, it may remain stationary or become greatly increased in severity owing to the raised thyrotrophic activity of the pituitary gland resulting from the absence of the thyroid gland. Both experimentally and in man a rapid progression of the proptosis in the thyrotrophic variety may follow a thyroidectomy when the basal metabolism is often below normal, and this fact has given rise to the erroneous belief that hyperthyroidism is not an essential factor in the development of the proptosis in thyrotoxicosis and that the mechanism of the exophthalmos in both hyperthyroidism and hypothyroidism is similar. The true position is that hyperthyroidism is necessary for the appearance of the proptosis in thyrotoxicosis but in the thyrotrophic variety hyperthyroidism plays no essential part in its development although remaining an associated feature of the disease.

Such has been the history of events leading up to the present-day attitude in which the phenomenon of exophthalmos associated with hyperthyroidism is thought to possess a single pathogenesis. Observations in connection with the interpretation of the recent experimental work which has confirmed or conduced to this idea have also been included. It remains now to examine the possibilities of the differentiation of the two varieties of exophthalmos which for convenience have been termed respectively thyrotoxic and thyrotrophic, indicating thereby without claim to etiologic comprehensiveness an essential component of the pathogenesis.

#### ANATOMIC FACTORS CONCERNED IN THE MAINTENANCE OF THE NORMAL POSITION OF THE EYE

Before consideration of the possible factors concerned in the development of exophthalmos in hyperthyroidism, it may

be useful first to examine the mechanism which normally maintains the eye in its natural position. Briefly, it is known that the globe is retained firmly within the capsule of Tenon by means of numerous fine trabecula stretching between the two structures and by various expansions which attach themselves to the tendons of the ocular muscles as they pass through its wall. The capsule itself is steadied by bilateral attachments to the orbital tubercles and is reinforced below by a thickening of its anterior portion, known as the ligament of Lockwood. All these structures serve to stabilize the position of the eye without affecting its range of movement. There are, however, other factors of a less fixed character which are capable of influencing the position of the globe. The following are the three most important:

I. *The tone of the voluntary ocular muscles.* These muscles consist of the four recti and the two obliques and their function is concerned with more than just eye movement. In the words of Whitnall (1921) "... The eye is delicately poised . . . and a state of equilibrium is maintained by the tone of the extraocular muscles. As a whole, the four recti may be regarded as retractors of the ocular bulb; they are antagonized by the obliques which, from their origins and the direction of their fibers, act as protractors and this is the active element maintaining the equilibrium of the globe." Rarely, the obliques are able to dissociate their power of contraction from that of the recti, allowing a state of voluntary exophthalmos to be produced. Normally, however, this dissociation is impossible and the combined tone of the recti muscles is sufficiently powerful to resist any tendency to proptosis, even in the face of most intense stimulation of the cervical sympathetic nerve. It is interesting, therefore, to recall that in certain conditions, such as myasthenia gravis and neurosyphilis, in which there may be an associated weakness or palsy of the eye muscles, exophthalmos may be present as a clinical feature. In thyrotoxicosis, the presence of ocular-muscle weakness is closely related to the development of the proptosis and yet more nearly to the disturbance of eye movement.

II. *The width of the palpebral fissure.* It is a well-known phenomenon that in normal

people wide retraction of the lids may be accompanied by a slight degree of proptosis, due doubtless to a lessening of pressure on the anterior surface of the globe occasioned by the tonic contraction of the orbicularis oculi. The extent of exophthalmos which may follow this movement depends on the relative grades of tone existent in the sphincter and the retracting muscles, and it may be expected, therefore, that the phenomenon will be more readily seen in thyrotoxicosis, owing to the associated extraocular weakness. This is generally the case, and excellent illustrations of the fact are available in an article by Tilley (1926) in which an excursion of the globe to the extent of 4 or 5 mm. was noted to follow the maneuver. With the eyes closed or opened in normal fashion, very little exophthalmos was visible; but as the lids were widely retracted the eyeball moved rapidly forward and appeared to be protruded through the enlarged fissure. Hence, the width of the palpebral fissure in thyrotoxicosis often bears some relationship to the degree of exophthalmos, particularly when associated with lagophthalmos due to sphincter weakness.

III. *The bulk of the retrobulbar tissues.* Normally, the retrobulbar fibro-fatty tissue accommodates itself to the space within the extraocular cone of muscles, being equitably disposed to exert an even pressure on the rear of the globe. Slight alteration in the volume of this cushion may modify the position of the eye, as may be recalled from the hollow-eyed appearance associated with wasting or the bulging orbits of the obese alcoholic. In thyrotoxicosis, there is no real increase in the bulk of the retrobulbar tissues, as has abundantly been proved at autopsy, although the intraorbital fat may be more loosely spread and indeed increased in the degenerating muscles. Hence, in exophthalmic goiter, this factor plays no part in the development of the proptosis. On the other hand, the exophthalmos of thyrotrophic origin is produced solely by an expansion of the intraorbital contents taking place within the bony confines of the orbit.

Of these three factors therefore capable of influencing the position of the eye, it may be stated that in thyrotoxicosis the tone and strength of the recti muscles are of primary importance, the width of the palpebral fissure of minor character, and the volume of the retrobulbar tissues of no consequence at all. Conversely, in the thyrotrophic variety, the first two items exert no influence, the last-named factor

constituting the sole operative agency.

With these brief anatomic considerations in mind, the differentiation of the two types of exophthalmos will follow.

#### A. THYROTOXIC EXOPHTHALMOS: ITS MECHANISM, PATHOLOGY, SYMPTOMATOLOGY, AND TREATMENT

##### I. MECHANISM OF THYROTOXIC EXOPHTHALMOS

It may be remarked that the most important guiding observation in this respect has been the incontrovertible fact that in the numerous autopsies conducted on persons dying of typical thyrotoxicosis nothing very much of note has been discovered in the orbit. It is important to bear this fact in mind for there has been a tendency to overlook it, following the description of the orbital changes in animals consecutive to the administration of anterior-pituitary extracts and the discovery of identical findings in the human orbit in certain cases of progressive post-thyroidectomy exophthalmos. In both these states the proptosis unquestionably has developed in response to a raised intraorbital pressure, and it has been assumed in certain quarters that the exophthalmic mechanism in thyrotoxicosis is due to a similar morbid process. This assumption is erroneous. The development of pressure in the thyrotrophic variety is brought about by constant alterations in the eye muscles, comprising increased girth, edema, fibrosis, and round-celled infiltration. These distinctive features are absent in the thyrotoxic orbit, often there being no naked-eye abnormality. This definite and conclusive finding assists one to dispose of those theories in which the mechanism is based upon increased retrobulbar pressure. It may be emphasized that neither clinically nor pathologically is there ever anything in typical thyrotoxicosis to indicate that in-

creased retrobulbar pressure is the cause of the proptosis, and it is of little value to consider any hypothesis which does not take this fact into account. Consequently the logical conclusion may be accepted that the responsible mechanism of the proptosis, not being governed by pressure from behind, must depend upon forward traction of the globe. Allusion has been made to two factors, sympathetic overaction and ocular-muscle weakness, which have been thought capable of producing exophthalmos in thyrotoxicosis. It remains now to examine their likelihood.

THE SYMPATHETIC COMPONENT. It has been maintained since 1858 that sympathetic overaction plays an essential part in the development of proptosis in thyrotoxicosis. This idea has grown because sympatheticonia is a constant accompaniment of the disease; because experimental stimulation of the cervical-sympathetic nerve in animals has produced proptosis and lid retraction, and because the absence of an obvious mechanical or voluntary force implies the functioning of involuntary effort. Recently a suggestion that spasm of the levator palpebrae is responsible for upper-lid retraction has been made by Pochin (1939b) on the ground that the effects of stimulation of the cervical sympathetic in man, comprising dilatation of the pupil, retraction of both lids but not exophthalmos, are not seen in thyrotoxicosis. There is little evidence to support this view, and the relief of lid retraction sometimes following cervical sympathectomy is a strong pointer against the agency of striated muscle; at the same time the three points of distinction raised are capable of explanation. The main difficulty in ascertaining the part played by the sympathetic system has been to establish the anatomic basis of the mechanism involved; hence it is of some consequence to find that the unstriped

musculature of the anterior half of the orbit as described by Müller and Landström is suitably disposed to effect forward traction on the globe.

*Landström's orbital muscle* consists of a cone of unstriated muscle surrounding the front part of the globe. It extends from the back of the orbital septum an-

confused with Müller's orbital muscle, consist of small bands of unstriated muscle in the region of the lids and appear to comprise specialized portions of Landström's muscle. The superior muscle is the more important and corresponds in position to the middle division of the insertion of the levator palpebrae, stretch-



Fig. 1 (Mulvany). Landström's muscle. Sections from anterior orbit showing the extensive and close attachment of the smooth muscle (m) to the globe (Landström, 1907).

teriorly to the region of the equator of the globe, where it is connected to fascial expansions derived from the ocular muscles near their point of attachment to the eye. The muscle is widely distributed and of surprising strength, as may be gathered from a perusal of Landström's original work (fig. 1). The main fasciculi lie close to the globe and many are inserted directly into fascial investments of the ocular muscles. The muscle gains its power from the concentric arrangement of numerous bundles exerting a short direct pull.

*Müller's palpebral muscles*, not to be

ing from the region of the tendon of the superior-rectus muscle to the tarsus, to which it is attached. Lid retraction in Graves's disease is attributed to spasm of this muscle, but the practicability of its contraction contributing to the development of the exophthalmos appears to have been overlooked. The effect, however, is conveyed to the upper pole of the globe through the intimate fascial connection which exists between the levator and the tendon of the superior rectus (fig. 2). The function of this band normally is to facilitate raising of the lid on elevation of

the eye, and its practical importance is emphasized in the lid retraction or ptosis which may follow recession or an advancement of the superior-rectus tendon, respectively. Spasm of the unstriped muscle in this position effects a pull between the tarsus and the point of insertion of the upper rectus; hence, in producing lid

the eye is rotated downward. Spasm of these fibers exerts a direct pull between the tarsus of the lower lid and the under surface of the globe.

The tension of these small muscles of Müller is not insignificant, as may be gauged in certain instances when attempting approximation of the lids. Working

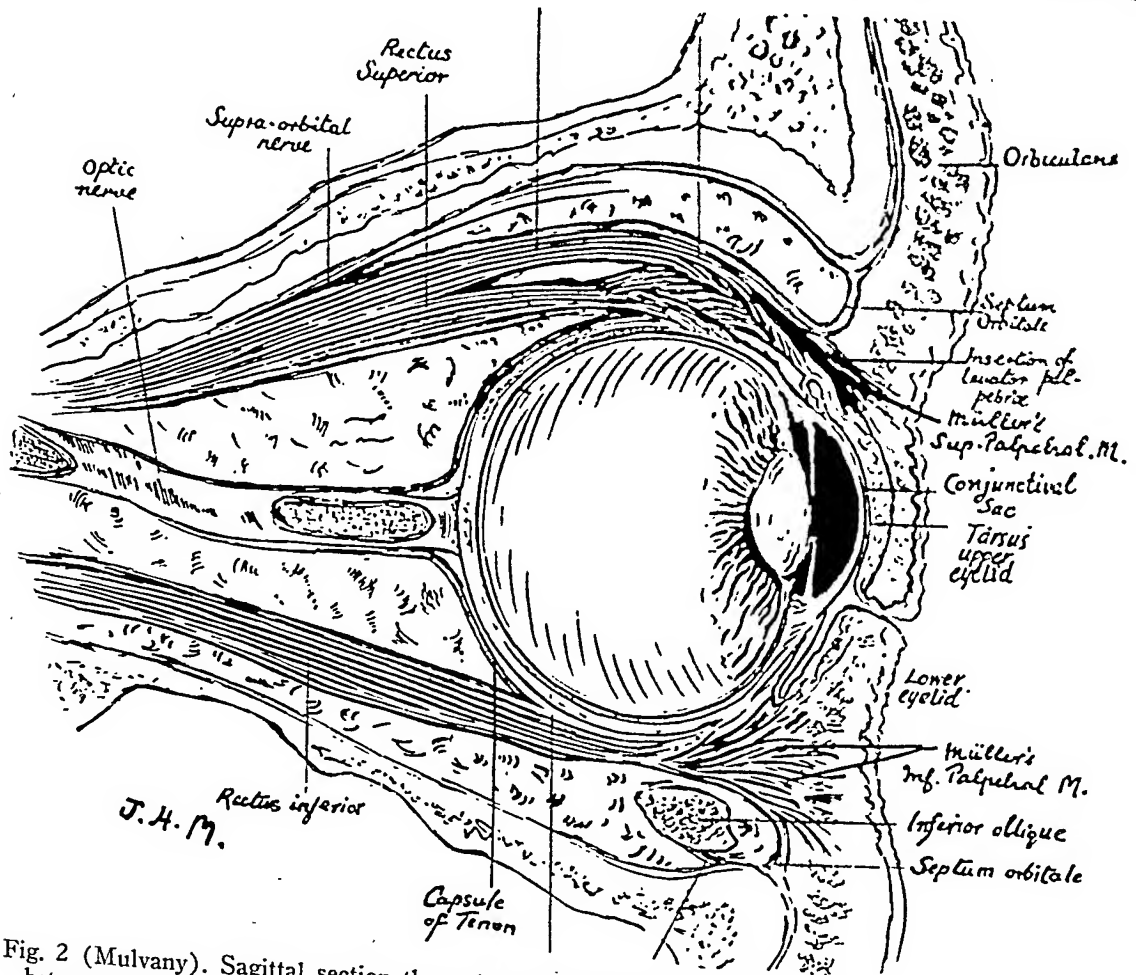


Fig. 2 (Mulvany). Sagittal section through orbit, showing Müller's palpebral muscles stretching between the lids and the tendons of the upper and lower recti muscles (semidiagrammatic).

retraction, there is a tendency also to proptosis.

In the case of the inferior palpebral muscle, a more direct mechanism is apparent although the fibers are less well developed. The smooth muscle is contained in the fascial expansion from the tendon of the inferior rectus to the lower lid, the normal function of which is to assist depression of the lower lid when

in conjunction with Landström's muscle, the combination is able to effect a steady forward pull on the globe (fig. 3) and should be capable of producing all degrees of exophthalmos provided there is coincidentally sufficient impairment of tone of the voluntary muscles. It should be appreciated that the proptosis is achieved not by the active contraction of opposed sets of muscles but by the steady unflag-



ging pull of small, spastic fibers operating against weakened and hypotonic ones.

**COMPONENT OF OCULAR-MUSCLE WEAKNESS.** The possibility of weakness of the eye muscles as a factor in the mechanism

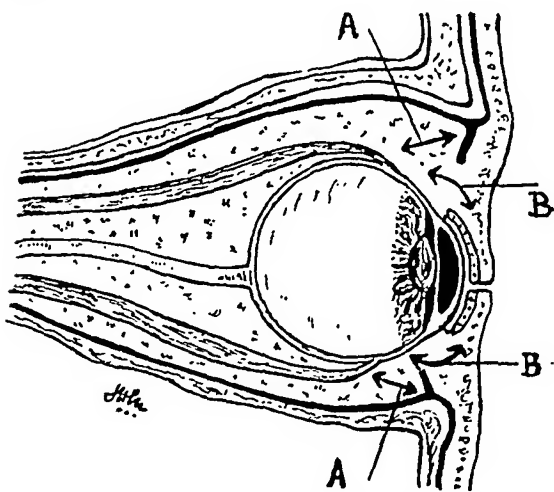


Fig. 3 (Mulvany). Diagram illustrating direction of pull of anterior orbital smooth muscle. A, Landström's muscle; B, Müller's palpebral muscles.

of thyrotoxic exophthalmos was pointed out in 1849 by Cooper. The idea has since presented itself to several observers, notably Moebius (1886), Lemke (1894), Sainton and Hesse (1931), and recently Plummer and Wilder (1935).

Generalized myasthenia, of which the eye-muscle weakness forms partly a local expression, is a fairly constant accompaniment of thyrotoxicosis, although in its mild form it may pass unnoticed by the patient and remain unrecognized by the clinician. Commonly it is manifested clinically by a variable amount of weakness of the quadriceps femoris or of the ocular muscles, but occasionally severe types are encountered in which the main disturbance may be noted in the limbs, giving rise to a paraparesis, as described by Charcot (1885), or in the muscles supplied by the cranial nerves, in particular those of the eye. In grave cases death may occur from bulbar asthenia. Hence it is not surprising to find these severe grades of thyrotoxic myasthenia erroneously spoken of as myasthenia gravis complicating exophthalmic goiter, a conclusion which overlooks the fact that myasthenia, whatever its cause, is no more than a symptom indicating a facilitation of the choline-esterase process at the neuro-

muscular junctions and does not constitute a disease in itself. Thus there are at least two other unrelated conditions which may present a typical picture of myasthenia gravis. For instance, the injection of an appropriate dose of curare into a vein induces a state of muscular weakness, initiated by diplopia and bilateral ptosis and followed rapidly by loss of power over the distribution of the remaining cranial nerves, weakness of the arms and legs, and finally by respiratory failure due to intercostal and diaphragmatic paralysis. The condition is relieved by an injection of prostigmine. In other words, "myasthenia gravis," rather "*acceleranda*," can be reproduced by an agent known to interfere with the proper functioning of the myoneural junction and cured by another which restores its normal operation. Another example of typical "myasthenia gravis" not uncommonly occurs in connection with a tumor of the thymus gland, and it is not improbable that it also would be cured by the removal of the diseased organ.

The essentially thyrotoxic nature of the muscle weakness in exophthalmic goiter is shown in the relief afforded by a thyroidectomy or occurring during a remission of the disease. Thyrotoxic myasthenia, therefore, although presenting many similarities to myasthenia gravis, deserves to be distinguished from that condition. Points of difference are seen in the response to rest and prostigmine, which is reduced in effect and duration and may be absent in the case of the ocular palsies. The alteration is probably caused by the hypotonia and persistent weakness occasioned by the widespread degenerative process present in the muscles and nerves.

The eye muscles undoubtedly suffer in greater measure from the toxic agent than does the rest of the skeletal musculature. The reason for this selectivity is a matter for conjecture although it is possible to advance three suggestions:

(a) The eye muscles are composed of a special type of fiber not to be found elsewhere in the body (Woollard, 1930-1931), being of a fine and delicate structure richly supplied by nerves. It would be consistent with this refinement of make-up for these muscles to be associated with



properties of a less durable nature than the coarser type of fiber found elsewhere.

(b) The eye muscles are the only muscles in the body capable of responding to a nonspecific chemical stimulus while the nerve supply is intact. Other skeletal muscles will not contract when so stimulated unless the nerves have degenerated, as after section, or before they have grown into the muscles, as in the fetus. If, therefore, the eye muscles are more susceptible to chemical stimuli than any of the others, it would not be unreasonable to suppose that they would be more readily affected by a chemical toxin or toxemia, of which thyrotoxicosis is a first-class example. This view receives strong support from the fact that the type of degenerative change in the ocular muscles is out of all proportion to anything found elsewhere in the body.

(c) The abundant nerve supply is greatly affected by the morbid process taking place within the muscle bundles, often showing gross deterioration, and even disintegration, particularly in the finer terminal divisions. There can be no doubt that this disorganization of nerve supply is not without consequence upon the functioning of the muscles, and its extensive distribution within the eye muscles accounts partly for the greater disturbance of movement.

**CLINICAL CONSIDERATIONS.** Strong clinical confirmation of the influence of ocular-muscle weakness on the development of thyrotoxic exophthalmos has been presented by Plummer and Wilder (1935). These observers examined the problem by ascertaining the possibility of correlating the degree of weakness present as tested by a carefully graded series of exercises of the quadriceps and the degree of exophthalmos. The basis of the correlation was presumed to rest upon the assumption that the loss of strength in the

quadriceps would be paralleled by a similar loss in the extraocular muscles which would predispose to forward dislocation of the globe. Some 2,000 cases were examined and the results of their observations enabled them to state that a positive correlation as outlined above existed. Thus in those cases in which no weakness of the quadriceps was detectable clinically, the percentage of exophthalmos present was 44; but in those in which weakness was evident, the frequency of the proptosis varied between 53 percent and 63 percent according to the degree of myasthenia present. The incidence of exophthalmos was therefore 10 percent to 20 percent higher in those cases with detectable myasthenia and in the main corresponded with the more severely toxic patients, the ratio of the proptosis falling concurrently with the rate of the metabolism.

B.M.R.	Cases with Exoph- thalmos	Cases with no Exoph- thalmos	Ratio
+70-+80	102	55	1.86 to 1
+50-+60	213	145	1.46 to 1
+30-+40	163	195	0.83 to 1
+20-+30	115	155	0.74 to 1

(Modified from Plummer and Wilder, 1935)

In certain instances of exophthalmic goiter, the loss of tone in the ocular muscles is so great that a sneeze or nod of the head may result in complete luxation of both globes in front of the lids and in their replacement, which is usually not difficult, the marked hypotonia and absence of increased intraorbital pressure may be clearly appreciated. On the other hand, the eye muscles may be so little affected that no exophthalmos develops.

**EXPERIMENTAL CONSIDERATIONS.** Additional information on the mechanism of thyrotoxic exophthalmos may be obtained from an examination of experimental evidence. It is known that feeding with

thyroid extract in animals does not lead to exophthalmos, and the finding may be explained on the basis that a state of hyperthyroidism is produced without an accompanying sympatheticotonia; but it is possible in these animals and also in man rendered artificially hyperthyroid by thyroid medication to induce a proptosis by the administration of a sympathomimetic drug. The experiments of Labbé and others (1931, 1933) have shown this. Labbé found that in dogs a dose of ephedrine equivalent to 0.5 mg. per kilogram of body weight was followed only by a questionable degree of proptosis, but that if thyroxine were given intravenously beforehand a marked exophthalmos, not dependent on increased retrobulbar pressure or edema, was produced. This exophthalmos, typically "basedowienne," could be made to recede regularly under the stimulating influence of yohimbine. Thus the coöperation of smooth-muscle spasm and extraocular-muscle weakness was effectively demonstrated; but the investigators carried their experiments a stage further by testing their views on the human being. The patient, an obese woman, had been taking daily a large dose of thyroxine (10 mg.). Marked signs of hyperthyroidism were present when the patient was given 50 mg. of ephedrine. Within five minutes, a prominent exophthalmos, more marked on the left side, had appeared and persisted for two hours. These observers also found that in other patients with exophthalmic goiter the administration of ephedrine accentuated the proptosis.

Equally instructive was the case described by Sainton and Hesse (1931) in which exophthalmos developed in a myxedematous patient as a result of treatment with adrenalin and thyroxine. The patient, with a long-standing case of myxedema, had been receiving a daily injection of 1 mg. of thyroxine. As a result

of treatment the pulse rate accelerated and the basal metabolism rose from -30 percent to -6 percent but fell later to -14 percent in spite of continued dosage. Thereupon the amount of thyroxine given daily was doubled and supplemented by adrenalin. Eight weeks later, the pulse rate had risen to 100, about 18 pounds in weight had been lost, and the basal metabolism was +59 percent. Bilateral exophthalmos was present and "le symptôme basedowien" was complete. On cessation of the adrenalin administration, but continuation of the thyroxine, the exophthalmos disappeared although the patient remained hyperthyroid.

In conclusion it may be stated that the anatomic, experimental, and clinical evidence accords well in favor of a mechanism based on sympathetic overaction and extraocular-muscle weakness, while there is very little that can be opposed to the view.

RELATION OF COCAINE TO EXOPHTHALMOS. Although not strictly relevant to the subject on hand, the rationale of the exophthalmos associated with the conjunctival instillation of cocaine merits a few words. The protrusion is accompanied by lid retraction and submaximal dilatation of the pupil, the light reflex remains and the dilating action of atropine is not opposed. These effects are not produced, as is sometimes stated, by local sympathetic stimulation, for cocaine has no effect on the sympathetic system anywhere else in the body and its action is not prevented by the previous administration of atropine. Cocaine, however, does possess the property of stimulating smooth muscle, and it seems that its effect on the pupil and lids is produced in this way by local permeation although this action in itself does not account for the proptosis nor explain why the ciliary muscle and the sphincter pupillae are relatively unaffected. Concerning the exophthalmos, however, it may be explained that the drug exerts constantly a depressant effect on striped muscle, even in the most dilute solutions, affecting excitability, contractility, and tone. This action is due to a direct effect on the muscle fiber or the receptor organ because it can arrest the action of drugs such as veratrine and quinidine which give rise to a contraction by acting on the myoneural junc-

tion. Absorption from the conjunctiva takes place through three channels, one of which comprises the lymph spaces around the extraocular muscles. Hence the tone of these striped muscles is reduced in consequence and a slight degree of exophthalmos may appear in response to the local stimulation of the anterior orbital smooth muscle. In connection with the subdued action of the drug on the ciliary and sphincter muscles, it may be assumed that its stimulating effect on the unstriped fibers of these muscles is countered to

tion." It was added that the muscles and nerves showed no histologic abnormality, and there was no mention of edema. This statement is only partially correct, for fatty degeneration can be made out in the muscle fibers which together with the nerves show many histologic alterations. Askanazy (1898) found extensive changes in many parts of the skeletal musculature, comprising loss of striation to absorption of entire muscle fibers. A striking feature was a widespread lipomatosis of the voluntary muscles. Later, Dudgeon and Urquhart (1926)

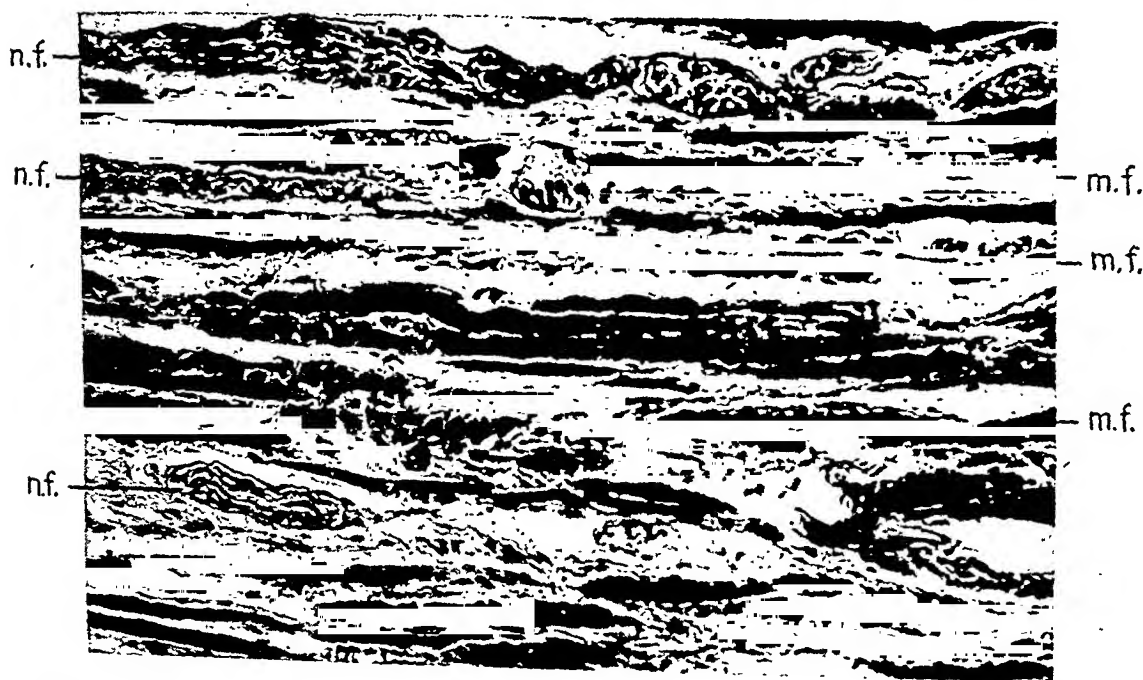


Fig. 4 (Mulvany). Eye muscle from severe case of thyrotoxicosis. Note general wasting of muscle fibers and irregularity in size, shape, and density (m.f.). Observe also abundant nerve supply, showing extensive and severe degeneration (n.f.).

a certain extent by a depressant effect on the oculomotor end-plates, so that the purely sympathetic-supplied dilator is relatively freer to respond.

## II. PATHOLOGY OF EYE-MUSCLE CHANGE IN THYROTOXICOSIS

One of the earliest inquiries into the condition of the eye muscles in Graves's disease was made by Silcock (1886). His observations appertaining to a severe case showing advanced proptosis with almost complete immobility of the eyes were as follows: "There was nothing abnormal in the orbits except most noticeably a yellowish patchy discoloration of the recti and obliques which microscopical examination proved to be due to diffuse fatty infiltration, the muscles themselves though somewhat pale showing no trace of fatty degenera-

tion." It was added that the muscles and nerves showed no histologic abnormality, and there was no mention of edema. This statement is only partially correct, for fatty degeneration can be made out in the muscle fibers which together with the nerves show many histologic alterations. Askanazy (1898) found extensive changes in many parts of the skeletal musculature, comprising loss of striation to absorption of entire muscle fibers. A striking feature was a widespread lipomatosis of the voluntary muscles. Later, Dudgeon and Urquhart (1926)

examined the muscle in eight cases of Graves's disease and found changes which were attributed to chronic interstitial myositis. There was a proliferation of the interstitial cells and atrophy of the fibers in varying degrees. A small number of lymphorrhages were found, being small in size and most frequent in the eye muscles.

It is remarkable that in these contributions and in others that have since appeared on this subject, no mention has been made of the nerve degeneration which often equals in intensity the muscle changes.

Briefly, the pathologic changes may be summarized as follows: Inspection reveals the muscles to be thin and sometimes pale, occasionally showing the patchy discoloration noted by Silcock. Microscopy shows a widespread and often extensive degeneration of the muscles and their at-

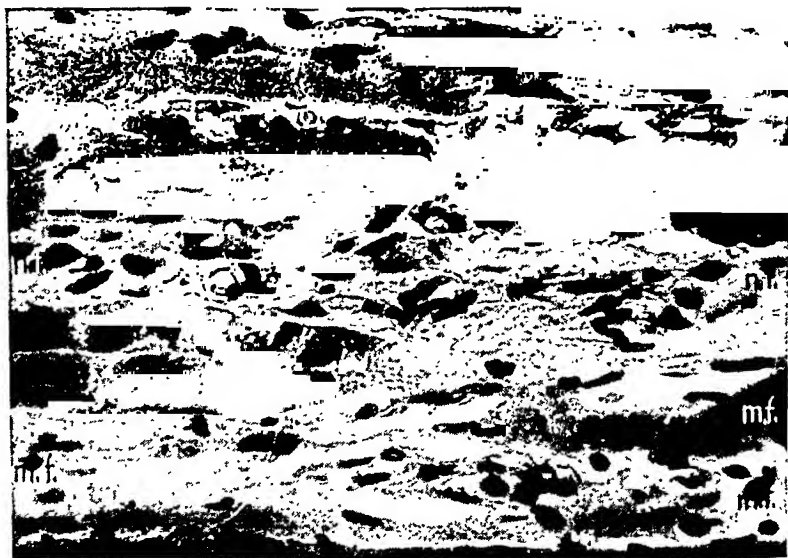
tendant nerves leading to the ultimate destruction of both (figs. 4-8). The muscle fibers show loss of striation, fibrillation, and granulation of the sarcoplasm followed by its absorption. This takes place either as a result of fragmentation, portions of fiber retaining a few nuclei breaking off, or by a more gradual process involving the whole length of a fiber, the density of which lessens until the fine sup-

ply (fig. 5). The neurilemma becomes granular and undergoes absorption so that in transverse section the fiber appears as an irregular ring with a nucleus placed rather eccentrically. Proliferation of the neurilemmal cells is also evident and often exceeds that of the muscle sheaths (fig. 6). These cells sometimes assume a pear-shaped form having a granular nucleus. Others resemble a lymphocyte but



Fig. 5 (Mulvany). Eye muscle from thyrotoxicosis. Swelling of (n.f.) nerve fiber with granulation of neuroplasm. Slight proliferation of nuclei of neurilemmal sheath.

Fig. 6 (Mulvany). Thyrotoxic eye muscle. Degeneration of muscle (m.f.) and nerve (n.f.) fiber in close proximity. Note disorganization of both, the nerve fiber showing marked reduplication of neurilemmal cells, some of which have characteristic pear-shaped appearance with eccentric nucleus.



porting structure appears and is later absorbed. The nuclei often remain to the last. Proliferation of the sarcolemmal cells is a common feature although not generalized. In its earliest form it is seen as a pairing of the nuclei along the course of the fiber.

Equally constant are the changes in the nerves, which appear to suffer in the same degree as the muscles. The alterations are most marked in the smaller terminal branches, particularly alongside the muscle fibers which they

contain rather more cytoplasm. Occasionally the terminal portion of the nerve fiber may degenerate into a husklike body containing practically no axon tissue (fig. 7).

The cellular distribution is diffuse but sparse (fig. 8). Many of the scattered cells appear to be derived from the nuclei of disintegrating nerve and muscle fibers, some of them undergoing transformation into fibroblasts. Small aggregations of lymphocytes occasionally occur but are few in number, and one may examine

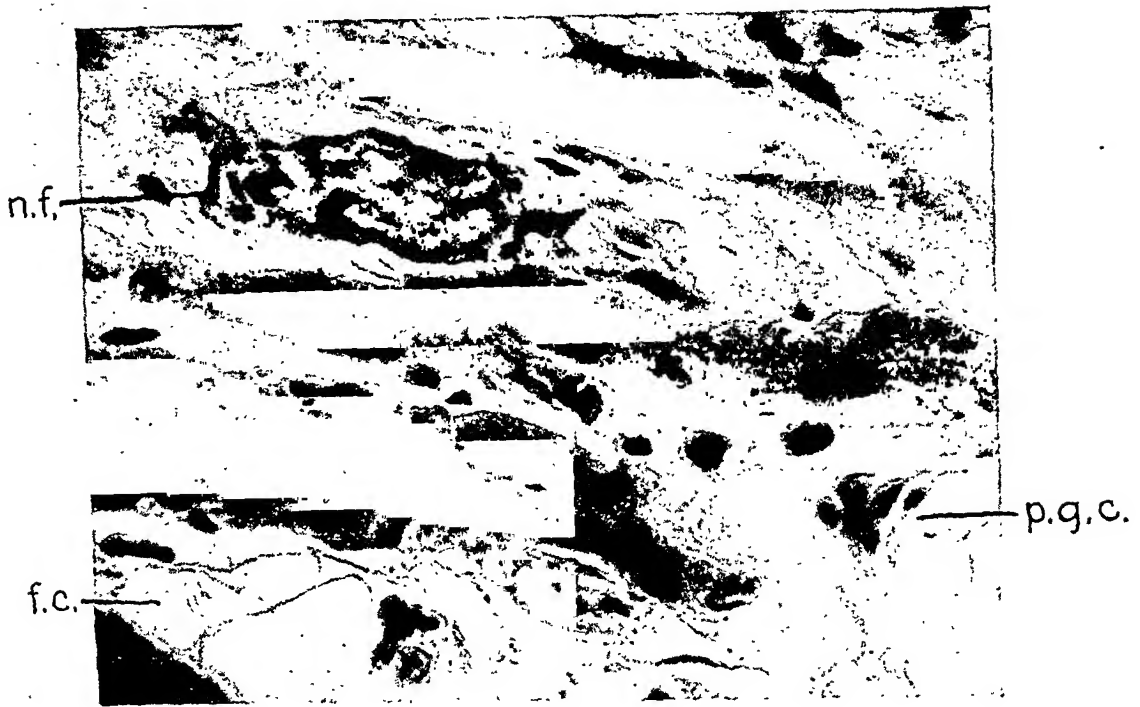


Fig. 7 (Mulvany). Thyrotoxic ophthalmoplegia. External-rectus muscle showing loss of striation, granulation of sarcoplasm, and reduplication of sarcolemmal nuclei. Note degenerated nerve husk (n.f.), pseudogiant cells due to portions of muscle fiber breaking off (p.g.c.), and few fat cells (f.c.). One muscle fiber is about twice the size of another.

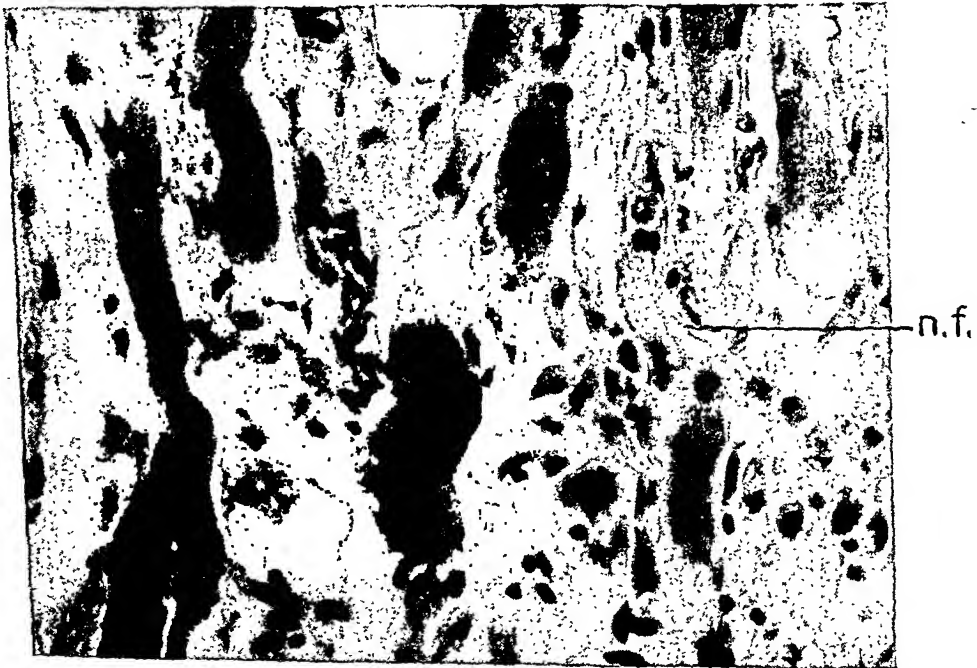


Fig. 8 (Mulvany). Thyrotoxic eye muscle. Note scattered yet sparse cellular distribution. Many cells are derived from degenerating nerve and muscle fibers. Note nerve husk (n.f.) and pear-shaped neurilemmal cells adjacent.

many fields without encountering them. Fat cells tend to increase in number, and many of the muscle fibers show varying degrees of fatty degeneration. In severely toxic cases, the interstitial fatty infiltration may attain the proportions of a lipomatosis which occasionally may equal in degree the diffuse infiltration accompanying motor atrophy of the tongue (fig. 9).

The other orbital structures escape disturbance. The optic nerve remains healthy and there is no change in the lacrimal gland. It

appearance of exophthalmos depends on the simultaneous occurrence of weakness of the voluntary extraocular muscles and spasm of the anterior orbital smooth muscle, and it is not surprising to find that many of the associated features are based on these two factors. Others depend on complex disturbances of local muscle control, on local vascular alterations, and on

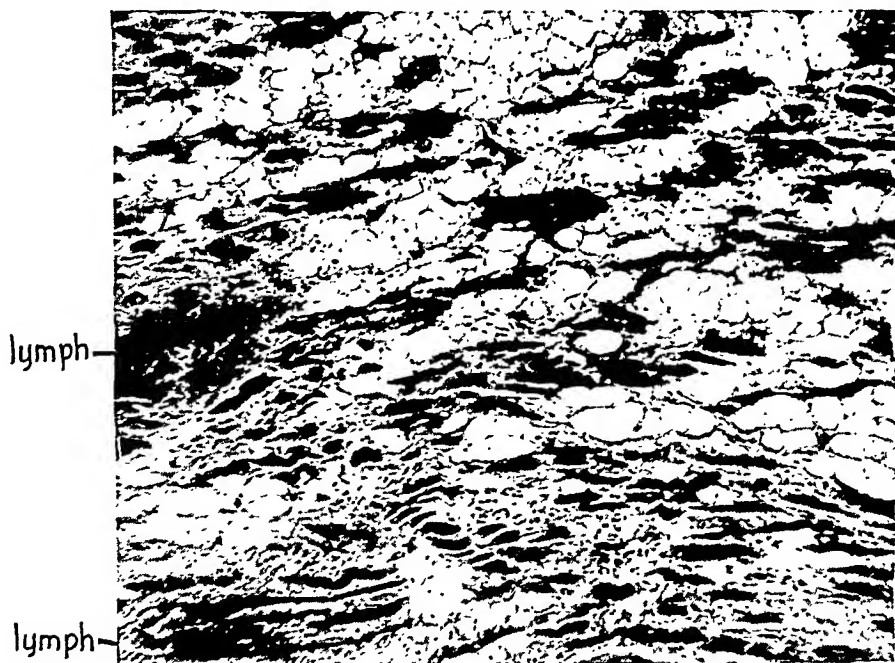


Fig. 9 (Mulvany). Thyrotoxic eye muscle showing marked fatty replacement of muscle fibers. Two lymphorrhages (lymph.) are present.

may be emphasized that edema, diffuse or extensive round-celled infiltration, or marked fibrosis is absent.

### III. SYMPTOMATOLOGY OF THYROTOXIC EXOPHTHALMOS

The clinical features of this condition are so well known that observations will be confined to three items; namely, a classification of the eye phenomena grouped accordingly to mode of origin, the oculomotor palsies and their mechanism, and corneal ulceration. A few remarks on an early clinical sign will also be included.

1. CLASSIFICATION OF OCULAR PHENOMENA. It has been observed that the

exposure; while not a few, such as edema of the eyelids and ophthalmic neuralgia (both apart from corneal ulceration) and optic neuritis, are more properly features of the thyrotrophic variety of proptosis than of thyrotoxicosis and therefore have not been included in the underlying table.

*a. Signs due to disturbance of orbital-muscle balance.*

(1) Signs Due to Reduction of Voluntary Eye-muscle Tone

Ballet (1888): Weakness of external rectus muscle.

Basedow (1840): Lagophthalmos, inability to close eyes.

Joffroy (1893): Loss of wrinkling of forehead due to frontalis weakness.

Kast/Wilbrand (1891): Visual restriction due



to weakness of extraocular muscles.  
 Moebius (1886): Difficulty in convergence.  
 Suker (1917): Difficulty in following horizontal movement.

### (2) Signs Due to Overaction of Orbital Smooth Musculature

Claiborne/Rogers (1920): Mydriasis in advanced cases.  
 Cohen (1912): Hitch in lid movement.  
 Cooper/Dalrymple (1849): Spasm of "levator palpebrae" causing upper-lid retraction and exposing sclera above iris.  
 Curschmann (1922), Loewi (1921): Mydriasis following adrenalin administration.  
 Gifford (1906): Difficulty in eversion of upper lid.  
 von Graefe (1857): Exposure of sclera on downward movement of eye.  
 Knies (1895): Dilated and unequal pupils.  
 Kocher (1911): (a) Spasmodic retraction of upper lid on fixing an object. (b) On elevation, sclera is uncovered by lid moving first.  
 Koller (1903), Stellwag (1869): Retraction of both lids exposing sclera above and below cornea.  
 Pochin (1939b): Reduced amplitude of blinking.  
 Stellwag (1869): Infrequency of blinking.

### (3) Signs Due to Obscure Disturbance of Local Muscle Control

Curschmann (1917): Reversed Argyll Robertson pupil.  
 Freund (1891), Knies (1895): Tremor of eyeballs; nystagmus. Hitschmann (1894), Plummer/Ryneerson (1932): Increased frequency of blinking.  
 Liebrecht (1890), Hömen (1892), Rosenbach\* (1919): Tremor in upper lid when closed.  
 Wilder (1920): Jerking of eyes on changing from full abduction to adduction.

#### b. Signs due to local vascular alterations

Becker (1873): Abnormal pulsation of retinal arteries.  
 Drummond (1887), Mackenzie (1890), Jellinek\* (1904): Pigmentation of lids.  
 Oppenheim (1887): Pigmentation of conjunctiva.  
 Snellen/Donders (1871), Riesman\* (1916): Bruit over eyeball.

#### c. Signs due to exophthalmos

Basedow (1840): Lacrimation; conjunctivitis; chemosis, especially in exposed portions of conjunctiva; keratitis; perforation leading to panophthalmitis.  
 Berger (1902): Epiphora.  
 Knies (1895): Corneal insensibility.

Pain/Trousseau (1868), Burrows (1925): Dislocation of both globes.  
 Posey/Spiller (1906): Obliteration of superior orbito-palpebral sulcus.  
 Sattler (1909), Vigouroux (1887): Puffiness of lids not due to edema.  
 Topolanski (1936): Congestion of anterior region of eye.

Many of these signs refer to one feature or a variant of it and the majority are present only in association with an obvious exophthalmos. With the exception of upper-lid retraction, very few of them are early or helpful in estimating the presence of an incipient proptosis; and the value of upper-lid retraction is not great, as its occurrence is not confined to thyrotoxicosis, being not uncommon in normal individuals, particularly when of nervous temperament, in the anxiety states, in certain lesions of the C.N.S., and in local affections of the orbit. It would be helpful, therefore, if a more accurate method of assessing an early proptosis in thyrotoxicosis were available, and it seems that this is feasible. Most observers at one time or another will have received the impression of a slight degree of exophthalmos in a particular patient in the absence of definite criteria to that effect. In some instances, retraction of the upper lid or a staring expression has created the effect; but in others it probably has been the exposure of a small rim of sclera between the iris and the lower lid. Exposure of the sclera in this position was noted early by Basedow and Stellwag; but the cases in question were advanced, and it is not generally known that careful examination will show the presence of this feature very early in the course of the disease, as soon, if not sooner, than the Dalrymple sign.

In about 90 percent of normal people it is a fact that when the head is held naturally erect and the eyes are directed horizontally forward the lower lid just meets

\* The signs to which the names of Rosenbach, Jellinek, and Riesman are commonly attached were described so much earlier by other observers that the retention of these names for descriptive purposes is hardly warranted.



the lower margin of the iris, no sclera being visible between them. In thyrotoxicosis, this relationship is disturbed almost at once, owing to the combined effect of proptosis and lower-lid retraction (fig. 10). Exophthalmos by itself will produce this phenomenon very early, as was pointed out by Pochin (1938), but in exophthalmic goiter it is probable that its appearance is facilitated by a slight degree of lower-lid retraction which, however, is never marked owing to early rais-

head be held correctly. In general, this will be obtained by ensuring that a line drawn from the roof of the auditory meatus to the lower orbital margin is horizontal, but in practice visual appraisalment will suffice. A slight degree of forward tilt of the head or upward movement of the eyes will create a false white line while the reverse movements will tend to mask its presence in thyrotoxicosis. How necessary the correct stance is may be gauged from the frequency with which von



Figs. 10 and 11 (Mulvany). Early case of thyrotoxicosis. Fig. 10, showing appearance of lower scleral rim. Fig. 11, showing masking of lower scleral-rim phenomenon by raising of the level of the palpebral fissure occasioned by retraction of upper lid.

ing of the level of the palpebral fissure by retraction of the upper lid. The importance of this sign lies in the fact that it is clinically demonstrable before the exophthalmos is measurable and that it is present in about 75 percent of early cases; indeed, in the younger type of patient with the diffusely hyperplastic gland, it is almost universally perceptible and can be of particular aid to diagnosis in deciding between an anxiety state and early thyrotoxicosis when estimation of the basal metabolism may not be available and other features are equivocal. As mentioned above, however, the sign may be obscured at an early stage by the raising of the level of the palpebral fissure, which causes the lower lid once more to approximate to the margin of the iris (fig. 11). As the proptosis progresses, the white line reappears.

In examining for the test, it is important to bear in mind two points: (1) The test is delicate and it is essential that the

Graefe's sign is illustrated with the head in a position of backward tilt and the eyes directed downward. Under these conditions, normal people may show von Graefe's sign. (2) A small percentage of persons, between 8 percent and 10 percent, normally show a lower scleral rim when the conditions of the test are properly observed. In certain instances this is familial; in others it may be due to orbital shallowness, to a slight increase of orbital fat, or to some peculiarity in the conformation of the lower lid; while in a number of middle-aged men a very slight degree of unilateral and less commonly bilateral proptosis will tend to appear spontaneously. In a doubtful case, therefore, its significance should be assessed in relation to the position of the upper lid, which normally lies somewhere near the midpoint between the pupil and the top of the iris. In thyrotoxicosis, when exophthalmos is present, the upper lid is retracted;

hence the combination of lower scleral rim and upper-lid retraction is highly significant.

## 2. THYROTOXIC OCULOMOTOR PALSIES.

An indication of the process responsible for the appearance of the ocular palsies will have been gauged from the preliminary remarks on the mechanism of the exophthalmos in relation to thyrotoxic myasthenia and hypotonia. From the slight or moderate degree of weakness of the voluntary eye muscles which is a constant accompaniment of thyrotoxic exophthalmos to a palsy in one or other of them is a step of no great difficulty to follow, depending, no doubt, on an irregular distribution of the muscle weakness.

The thyrotoxic ophthalmoplegias bear many features in common with the eye palsies of myasthenia gravis, the points of greatest resemblance being the distribution—which may be limited to one or two muscles or more widespread, being associated with palsies of the other motor cranial nerves—and the tendency to improvement after rest or following an injection of prostigmine. Points of contrast are found in the early progression of an affected eye muscle to complete paralysis and the less characteristic response to prostigmine, a distinction probably connected with the associated neuromuscular degeneration. Nevertheless, brilliant exceptions occur. Fraser (1937) records a good response to prostigmine in a patient with bilateral ophthalmoplegia involving several muscles of about 12 years' standing, and Zondek (1938) describes a case of complete immobility of the eyeballs and generalized weakness in which most of the eye movements were restored after a single injection of 0.5 mg. of the drug (fig. 12). Improvement of this type, however, is rare and together with the myasthenic reaction is more likely to be found in the severe and rapidly progressing case.

As a rule, the thyrotoxic ophthalmoplegia is ushered in by ptosis or a diplopia, the latter being of a more stable character than that accompanying myasthenia gravis. The process may be limited to one muscle, in which case the levator palpebrae or, as noted respectively, by Moebius and Ballet, the internal and external recti.



Fig. 12 (Mulvany). Thyrotoxic ophthalmoplegia. Complete loss of ocular movement restored by prostigmine. Generalized myasthenia was also present (Zondek, 1938).

In the case of multiple lesions, bilateral ptosis with loss of lateral or vertical rotation is common, but numerous combinations are achieved although seldom without weakness in most of the other eye muscles. Total ophthalmoplegia may occur without a preliminary strabismus but is often associated with a disturbance of the cranial motor nerves and some degree of generalized myasthenia. Its course tends to be rapid, so that thyroidectomy should not be delayed.

In assessing the relative frequency of the various ocular palsies, not a great deal of help is derived from the literature, owing to the inclusion of instances of loss of eye movement accompanying the thyrotrophic type of exophthalmos. In this variety, the restriction of ocular movement is partly mechanical and occurs quite independently of any associated hyperthyroidism. It is almost exclusively in the direction of elevation in the initial

phase. Hence the impression has been gathered that paralysis of the superior-rectus muscle is the most frequent lesion in a thyrotoxic ophthalmoplegia when it is actually one of the less common. Loss of eye movement in thyrotrophic exophthalmos, however, not infrequently proceeds to total immobility, but the myasthenic reaction is never present nor is there the slightest response to prostigmine, which, indeed, is quite precluded by the

autopsy in one patient confirmed the operation findings.

3. CORNEAL ULCERATION. A few remarks concerning this complication may be of interest on account of the difference of opinion regarding the advisability of lid suture as part of the local treatment. The controversy is old and as long ago as 1896 formed the subject of discussion at a meeting of the Ophthalmological Society when no definite conclusions were attained. The origin of the disagreement appears to have been derived from a failure to distinguish between the ulceration occurring in Graves's disease and that of thyrotrophic exophthalmos. The causative factors leading to ulceration in these two varieties are different and require special methods of treatment. Corneal ulceration in thyrotoxicosis has never been common and today is still less frequent, owing to early diagnosis and treatment. When present it is generally of a superficial character which may persist with intervals of healing for many years in the absence of treatment to the thyroid gland. Little inconvenience may be caused in these cases unless secondary infection supervenes, when the condition may proceed to a panophthalmitis as it did in one of Basedow's cases. Spontaneous healing, however, without thyroidectomy is possible even in the most severe type (fig. 13). Usually the ulceration develops slowly but in certain severely toxic instances may appear rapidly and go on to perforation comparatively early.

The course and treatment of this complication differs little from that of ulceration due to more common causes. Thyroidectomy constitutes the first essential but may be combined with lid suture if the circumstances warrant it. This latter measure may be employed for all degrees of thyrotoxic ulceration when nonin-



Fig. 13 (Mulvany). End result of infected corneal ulceration following spontaneous subsidence of disease without thyroidectomy (Jesop, 1896).

nature of the pathologic process in the eye muscles. At this stage the differential diagnosis is straightforward, and it is of practical importance to the patient that this circumstance be recognized, for the success of Naffziger's orbital decompression in thyrotrophic exophthalmos has led to the operation's being performed needlessly in thyrotoxic ophthalmoplegia. The writer is aware that this procedure was carried out in 1938 on two patients suffering from advanced proptosis due to thyrotoxicosis—with a fatal issue in both, one succumbing from thyroid crisis and the other from auricular fibrillation. At operation, nothing was found in the orbits to account for the exophthalmos and

fects, for the tension between the lids and the globe is not severe and palpebral spasm can be relieved by section of the tissue containing the unstriated muscle at its point of attachment to the tarsal plates. The onset of infection and chemosis renders the problem more serious, owing to increasing surface tension. Relief of the pressure becomes necessary and may be accomplished by free tarsorrhaphy, by excision of portions of the chemosed conjunctiva, and by a paracentesis if complicated by hypopyon and a rising intraocular pressure. Approximation of the lids should be effected on a broad contact, aided if necessary by intermarginal splitting, as suggested by Priestley Smith (1913), but a small gap should be left at each canthus for drainage. In this way relief from pressure and exposure together with rest may be successful. Less thorough methods may be unsuccessful even when supplemented by thyroidectomy, and instances of failure have been recorded, one or both eyes having been lost before the beneficial effect of the thyroid operation could be appreciated. It is of interest to recall in this connection that after enucleation of the globe the orbital muscles were found to be atrophied and no excess of exuberant tissue was seen, a finding previously emphasized as being the constant accompaniment of thyrotoxicosis.

In thyrotrophic exophthalmos, the problem is gravely altered by the fact that the proptosis is produced by an irresistible increase of the intraorbital pressure which is countered by an equally forceful opposition from the edematous lids. The tension between the lids and the surface of the cornea may be enormous and quickly leads to chemosis and perforation. It follows therefore that lid suture here, however cleverly aided by tarsorrhaphy, will serve only to aggravate the vicious char-

acter of the morbid process. Hence disaster is the common sequel to treatment of this type of ulceration by lid suture, and it should be recognized that the sole means of saving the eye at this stage, as advocated by Naffziger, lies in orbital decompression.

4. TREATMENT OF THYROTOXIC EXOPHTHALMOS. Apart from local measures directed to effects resulting from exposure, treatment obviously will be directed to relief of the general condition, although regression of the proptosis following may be slight or even absent. The reason for this anomaly is fourfold: first, the stretching of the degenerated voluntary muscles has led to permanent lengthening of their fibers; second, retraction of the tissues lying between the lids and the region of the equator of the eye has occurred and tends to persist; third, the extensive morbid process involving the neuromuscular mechanism impedes the early return of normal tone and consequent ability of the muscle to retract; and lastly, with the fall in the basal metabolism, the retrobulbar space fills up with a more solid type of fat. The best chance of improving the exophthalmos after operation consists in aiding the retraction of the extraocular muscles during the early period of restoration of tone. This may be obtained by pressure on the globes sustained during sleep and for as many hours during the day as possible. After a few weeks the measure may be discontinued as the maximum improvement will then have taken place.

In cases of severe and persistent exophthalmos, the effect can be minimized by a narrowing of the palpebral fissure. This can be achieved by a tarsorrhaphy uniting the lids in the outer fourth or fifth of their extent. The maneuver has the merit of simplicity and is capable of re-

versibility should this be desirable. An alternate measure, particularly when lid retraction is marked, consists of a plastic operation of the type devised by Goldstein (1934), which has the effect of veiling the proptosis without producing a ptosis. A similar result has been obtained by a cervical sympathectomy, but the outcome of the operation is uncertain and disappointing. It is advisable, therefore, first to assess its possible value by ex-

amining the effects of local anesthesia of the lower cervical ganglion. Undoubtedly, the first measure is the one of choice. Concerning the treatment of the ocular palsies, when improvement has failed to follow a thyroidectomy, this should consist of the usual methods of advancement and recession of the affected tendons after an appropriate interval to allow of recovery of muscle tone has passed.

*(Part II will appear in the next issue.)*

## SUGAR CONTENT OF CATARACTOUS HUMAN LENSES\*

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Investigators have been interested in the sugar content of the crystalline lens for a long time—that is, since 1854, according to Lottrup-Andersen<sup>1</sup>—but their investigations were of only qualitative nature up to 1927, when Lottrup-Andersen for the first time made quantitative determinations. This author discusses some 33 references, only half of which reported sugar in the crystalline lens; all others failed to detect any sugar whatsoever. Lottrup-Andersen, using the modern Bang-Hagedorn micro-method, not only proved with certainty the presence of sugar in both normal and cataractous human lenses, but also showed wide variations in the sugar content between individual lenses of the same type as well as between groups of different kinds of lenses—that is, cataracts of the more common type, diabetic cataracts, and normal lenses. Their average sugar values were 46.3, 82.0, and 60.0 mg. percent, respectively. The analyses, however, were carried out on a rather small number of lenses—that is, 22, 3, and 5 lenses, respectively—and no attempt was made to

make comparisons between incipient, intumescent, and mature cataracts, on the one hand, and the different stages of sclerosis on the other as well as to compare the results on the basis of age. The average age of patients from whom normal lenses were obtained was considerably lower than that of the cataract patients, and this difference in age may have had something to do with the stated difference between the respective sugar values.

The present study was undertaken to supplement Lottrup-Andersen's work along the suggested lines.

The sugar was determined by a modification of Gibson's<sup>2</sup> colorimetric method for finger-tip blood sugar. Since by this modified procedure very small quantities of sugar can be accurately and rapidly estimated in any kind of solid animal tissue that gives clear supernatant fluid after the precipitation of the protein, it is given here in detail.

All the reagents were prepared as described in Gibson's method. After the lens was weighed on a small piece of filter paper, it was transferred, together with the filter paper, to a thick-walled 15-c.c. centrifuge tube. To this were added 3 c.c.

\* From the Department of Ophthalmology, College of Medicine, State University of Iowa.

of a freshly prepared mixture of the 1.25-percent sodium tungstate solution and the two-thirds N sulfuric acid in the proportion of 7 to 1, this proportion being more effective in precipitating the lens protein than Gibson's 5 to 1. The lens was removed from the filter paper into the tip of the tube by means of a blunt glass stirring rod and macerated and dispersed as finely as possible. Then the filter paper was treated in the same way and intermixed with the lens particles. The tube was stoppered and centrifuged at the rate of

$$\frac{15 \times 0.08 \times 100}{S \times W \times 0.667} = \text{mg. percent sugar,}$$
or 
$$\frac{15 \times 0.08}{S \times 0.667} = \text{mg. sugar per lens.}$$
In these formulas, 15 = the color reading of the standard, 0.08 = mg. sugar in 2 c.c. of standard, S = the color reading of the sample, W = weight of sample in grams, and 0.667 = two thirds of sample.

In all, 191 senile cataractous lenses, extracted by the intracapsular method, were analyzed. The results are arranged according to stage of cataract (table 1),

TABLE 1

MINIMUM, MAXIMUM, AND AVERAGE SUGAR VALUES OF CATARACTOUS LENSES ACCORDING TO STAGE OF DEVELOPMENT

Stage of Cataract	No. of Lenses	Age of Patient	Duration years	Weight gm.	Mg. per Lens	Mg. % in Lens	Mg. % in Blood
Incipient	118	40-87	0.5-20.0	0.1180-0.3055	0.022-0.176	10.4-58.0	44-297
Average		70.7	2.3	0.2061	0.085 (0.084)*	40.1 (39.5)*	131 (130)*
Intumescent	32	43-84	0.5-10.0	0.1256-0.2775	0.034-0.310	23.4-95.2	51-200
Average		70.1	2.8	0.2089	0.096 (0.076)*	47.1 (42.2)*	138 (121)*
Mature	41	51-86	0.7-12.0	0.1236-0.2300	0.033-0.191	18.4-84.3	72-221
Average		72.2	2.9	0.1807	0.073 (0.065)*	37.1 (35.1)*	130 (127)*

\* Diabetics excluded: Incip. 1 diab., 0.85 percent; Intum. 4 diab., 12.5 percent; Mat. 1 diab., 2.4 percent.

3,500 r.p.m. for approximately 10 minutes. The supernatant fluid was decanted into a 15-c.c. centrifuge tube, and 2 c.c. were used (in a Folin-Wu sugar tube) for analysis. In another tube 2 c.c. of the 0.004-percent sugar solution were used as standard. To each tube were added 2 c.c. of the alkaline copper tartrate reagent, and the contents were well mixed. The tubes were heated for six minutes in boiling water. After cooling under tap, 2 c.c. of the arseno-phosphotungstic acid reagent were added to each tube, and the contents were well mixed. Both sample and standard were diluted to 10 c.c. and mixed by inverting the tubes several times, after which their colors were compared in the colorimeter. For calculation the following formulas were used:

stage of sclerosis (table 2), and age of the patient (table 3).

The average duration of failing vision varies from 2.3 years for incipient cataracts to 2.8 years for intumescent and 3.9 years for mature cataracts.

The average weight of the lens increases from 0.2061 gm. in incipient cataracts to 0.2089 gm. in intumescent cataracts, then decreases to 0.1807 gm. in mature cataracts.

The 191 cataracts included six lenses from diabetics, one of which was incipient, four intumescent, and one mature. In terms of percentage they constitute 0.85, 12.5, and 2.4 percent of the total numbers (118, 32, 41) of the three groups of lenses, respectively. The sugar values in parentheses (see tables), marked with an

asterisk, represent averages exclusive of diabetics.

The absolute sugar values, or milligrams per lens, including diabetics, are 0.085, 0.096, 0.073 mg. for incipient, intumescent, and mature cataracts, respectively; with diabetics excluded, they are 0.084, 0.076, and 0.065 mg. In terms of milligrams percent, they are 40.1, 47.1, 37.1, and 39.5, 42.2, and 35.1, respectively. Thus in terms of milligrams percent there is a considerable increase in the sugar content in intumescent and some decrease

the lens only simultaneously. On the other hand, the fact that 12.5 percent of the intumescent cataracts come from diabetics (as against 0.85 and 2.4 percent for incipient and mature cataracts), shows a rather intimate connection between intumescence and diabetes, and it is reasonable to assume that diabetes may have something to do with the causation of intumescence and not vice versa. This assumption is strongly supported by the fact that the average sugar value (42.2 mg. percent) of intumescent cataract, exclu-

TABLE 2  
MINIMUM, MAXIMUM, AND AVERAGE SUGAR VALUES OF SCLEROSED LENSES ACCORDING TO STAGE OF DEVELOPMENT

Stage of Sclerosis	No. of Lenses	Age of Patient	Duration years	Weight gm.	Mg. per Lens	Mg. % in Lens	Mg. % in Blood
0 and +	14	43-78	0.5-4.0	0.1700-0.2424	0.037-0.176	20.9-113.4	87-192
Average		66.0	1.8	0.2074	0.083	40.5	134
++	27	51-85	0.5-20.0	0.1538-0.3055	0.046-0.158	27.8-63.8	78-297
Average		68.2	2.6	0.2068	0.091	43.0	130
+++	51	48-85	0.5-12.0	0.1586-0.2848	0.050-0.153	10.4-56.0	51-253
Average		71.3	2.1	0.2127	0.089 (0.084)*	41.5 (39.2)*	128 (125)*
++++	99	40-87	0.5-10.0	0.1180-0.2775	0.022-0.191	11.2-95.2	44-221
Average		72.1	2.9	0.1825	0.069 (0.061)*	41.2 (38.5)*	134 (129)

\* Diabetics excluded: +++ 2 diab., 3.9 percent; ++++ 4 diab. 4.0 percent.

in mature cataracts as compared with incipient cataracts. The question arises: Is intumescence the cause of the increase in the sugar content, or is the latter a contributing factor to intumescence? It may be reasoned that, since intumescent cataracts contain much more water than other cataracts, they must have greater solvent capacities for sugar. There is about twice as much sugar in the surrounding aqueous and vitreous humors as in the normal lens, and the tendency of the sugar molecules is to move from a solution of a higher to one of a lower concentration. This should be the case provided the extra solvent is already present in the lens. However, both the water and the sugar must come from outside, and can enter

sive of diabetics, is also significantly higher than that of incipient cataracts (39.5 mg. percent) exclusive of diabetics. A part of the sugar in the tissue is supposedly in combination with the protein<sup>3, 4, 5, 6</sup> and not in solution. On the disintegration of the tissue, as in autolysis, the sugar may be released in a soluble form and thus act as the attracting medium for water. The intumescent cataracts therefore are, on the whole, more or less intimately connected with disturbances in sugar metabolism.

The average blood-sugar values are nearly the same for patients with incipient, intumescent, and mature cataracts—that is, 131, 138, and 130 mg. percent, inclusive of diabetics, and 130, 121, and



127 mg. percent, exclusive of diabetics, respectively.

When the lenses, inclusive of diabetics, are arranged according to stage of sclerosis (table 2), no significant variations occur in the sugar content; the average values vary somewhat irregularly between 41.2 and 43.0 mg. percent. Exclusive of diabetics, a tendency toward lower sugar values during the last two stages of sclerosis (+++, +++) is, however, indicated, the average values for these last two groups being 39.2 and 38.5 mg. per-

cent and 5th, the 6th, and the 7th decades, varying from 0.080 to 0.088 mg. per lens, but in the 8th decade the value drops to 0.073 mg. No significant variations occur in the average values exclusive of diabetics. On the basis of percentage, the values, inclusive of diabetics, decrease from 45.9 mg. percent in the 4th and 5th decades to 39.7 mg. percent in the 6th decade, to 42.9 percent in the 7th decade, and to 36.2 mg. percent in the 8th decade. Exclusive of diabetics, they decrease from 40.0 mg. percent to 39.7, 39.7,

TABLE 3

MINIMUM, MAXIMUM, AND AVERAGE SUGAR VALUES OF CATARACTOUS LENSES ACCORDING TO AGE

Decade	No. of Lenses	Age of Patient	Duration years	Weight gm.	Mg. per Lens	Mg. % in Lens	Mg. % in Blood
4th and 5th	18	52.5	1.0-7.0	0.1380-0.2481	0.043-0.131	27.0-61.1	74-150
Average			3.3	0.1802	0.080 (0.074)*	45.9 (40.0)*	113 (112)*
6th	46	65.2	0.5-12.0	0.1445-0.2762	0.022-0.240	10.4-104.0	78-253
Average			2.1	0.1994	0.081	39.7	127
7th	107	74.2	0.5-20.0	0.1180-0.2848	0.037-0.191	18.4-84.3	44-297
Average			2.6	0.2042	0.088 (0.082)*	42.9 (39.7)*	131 (126)*
8th	20	83.0	1.0-10.0	0.1631-0.3055	0.044-0.141	23.4-50.0	84-217
Average			3.6	0.2045	0.073	36.2	145

\* Diabetics excluded: 4th and 5th 2 diab., 11.1 percent; 7th 4 diab., 3.8 percent.

cent as compared with 40.5 and 43.0 mg. percent for the first two groups, respectively. There are no significant variations in the sugar content of the blood inclusive or exclusive of diabetics, which fact should be attributed to the relatively small number of diabetics.

In table 3 the results are arranged according to age. The average duration of failing vision varies rather irregularly from 2.1 to 3.6 years. The average weight of the lens increases uniformly from 0.1802 gm. in the 4th and 5th decades\* to 0.1994 gm. in the 6th decade, to 0.2042 gm. in the 7th decade, and to 0.2045 in the 8th decade. The absolute sugar values per lens are nearly the same for the 4th

and 36.2 mg. percent, respectively. On the other hand, blood-sugar values, exclusive of diabetics, show an opposite tendency, increasing from 113 mg. percent in the 4th and 5th decades to 127 mg. percent in the 6th decade, to 131 mg. percent in the 7th decade, and to 145 mg. percent in the 8th decade. The same general tendency prevails with the values exclusive of diabetics; that is, an increase from 112 mg. percent to 127, 126, and 145 mg. percent, respectively.

The absolute sugar values of the six cataracts from diabetics vary from 0.128 to 0.310 mg. per lens, with an average of 0.226 mg. The relative values vary from 58.0 to 136.4 mg. percent, with an average of 103.1 mg. percent. These values are approximately the same as those for nor-

\* Fourth and fifth decades were combined on account of the small number of lenses.

mal blood. The blood-sugar values of the diabetics vary from 96 to 281 mg. percent, with an average of 217 mg. percent.

#### SUMMARY

In all, 191 senile cataractous lenses, extracted by the intracapsular method, were analyzed for their sugar content. Significantly, only 0.85 percent of the incipient, 2.4 percent of the mature, but 12.5 percent of the intumescent cataracts came from diabetics. Inclusive of diabetics, the average sugar value increases from 40.1 mg. percent in incipient cataracts to 47.1 mg. percent in intumescent cataracts, then decreases to 37.1 mg. percent in mature cataracts. Exclusive of diabetics, the

value increases from 39.5 mg. percent to 42.2 mg. percent, then decreases to 35.1 mg. percent respectively. The average sugar value of the six cataracts from diabetics is 103.1 mg. percent. The intumescent cataract is therefore intimately associated with general disturbances in sugar metabolism.

The average sugar value of the crystalline lens, exclusive of diabetics, decreases rather uniformly with age from 40.0 mg. percent in the 4th and 5th decades to 36.2 mg. percent in the 8th decade. On the other hand, that of the blood increases from 112 mg. percent to 145 mg. percent, respectively.

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## PNEUMO-ENCEPHALOCELE, SECONDARY TO A PUNCTURE WOUND OF THE LID\*

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*Saint Louis 10*

A case of pneumo-encephalocele is presented in which a brain abscess containing gas was suspected, secondary to a puncture wound of the upper lid.

C. M. A., a white girl, aged three years, entered Children's Hospital on April 6, 1943, with the following history and findings:

On the evening of March 23, 1943, the patient fell while carrying a pencil. She cried a good deal, but the mother noticed no injury to the child. The next morning the right eye was swollen shut. The patient was seen by a local doctor, who gave some local therapy. In two to three days the entire right side of her face was swollen. The patient was given a sulfa drug (dosage unknown) for five days, as the result of which the condition improved; she played and ate well, and the swelling subsided. On April 3, 1943 (10 days after the injury) the eye again became swollen, the patient became drowsy. The sulfa drug was again administered, but the child remained drowsy for the next three days, taking very little food or water from April 3, 1943, until her admission to Children's Hospital on April 6, 1943.

*Physical examination.* The child's temperature was 101.5°F.; her pulse rate 120; respiration 24. The white-blood-cell count was 11,750; red blood cells, 3,030,000; urinalysis negative.

The patient appeared toxic and was drowsy. Her skin was dry. There was no adenopathy. The general physical examination was essentially negative but for a

mild rhinitis on the right and the following findings in the right eye.

*Ocular examination.* The eye was swollen shut with a red, prominent, warm, upper lid. A small scar was seen in the upper lid just lateral to the middle of the lid. Very little reaction was present in the lower lid. The eye could be opened with effort. The conjunctiva was negative, except for edema above. The globe moved freely, but was displaced down and out. There was minimal proptosis. The pupil reacted to light. The patient was unable to elevate the globe.

A diagnosis of orbital cellulitis was made, and the patient was put on a therapy of sulfadiazine in adequate doses, tetanus antitoxin 1,500 units (none given previously), nose drops, and heat to the right eye.

*Course.* The patient was given special consideration upon examination for signs and symptoms of tetanus and cavernous-sinus thrombosis. She received a full course of tetanus toxoid initialed April 7, 1943. Cultures from the nose made on that date showed *Staphylococcus aureus*. The blood culture was negative on two occasions. The child continued to run a septic temperature (elevated to 103° to 104° in the afternoon) for the next few days. On April 9, 1943, the reaction in the lid seemed to become localized and with the patient under general anesthesia the area was aspirated. About 3 c.c. of a heavy yellowish-gray pus was obtained. On culture this aspirated material grew *Staphylococcus aureus*; but there was no attempt to make an anaerobic culture. The upper lid was then incised at the fold. An ophthalmoscopic examination

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under general anesthesia revealed only hyperemia of the disc of the right eye.

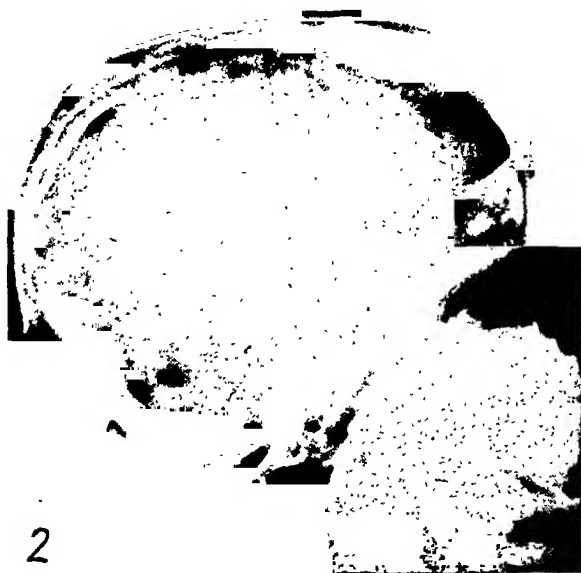
The patient received fluids subcutaneously and intravenously, and was given a blood transfusion on April 12, 1943, because of a low hemoglobin percentage. Also on this day a second pointing area was incised below the previous drainage site; no anesthesia was used. There was found to be an unusually large collection of pus under the orbital rim. When a hemostat was used to rupture and drain

of the disc; the blood vessels are dilated, tortuous, and pushed centrally at the disc.

Left eye: Margins of the disc are fuzzy; the veins show minimal dilation; neither hemorrhages nor exudates are seen in either eye.

The patient was unable to look up and had pain in the right eye if she made the attempt.

Thereafter improvement was marked. The administration of the sulfa drug was stopped, and the temperature was normal



Figs. 1 and 2 (Slaughter and Alvis). X-ray studies in a case of pneumo-encephalocele. Fig. 1, Position: head resting on the left side (April 12, 1943). Fig. 2, Position: head resting on left side (May 13, 1943).

this area through the original drainage site, pus under pressure was obtained followed by gas. It was noted that the usual smell of *Clostridium welchii* was not present. X-ray films of the right orbit were then taken. A cavity partially filled with gas (fig. 1) was discovered and a diagnosis of brain abscess containing gas in the right frontal lobe just overlying the orbital plate was made. The eye improved, drainage decreased and finally stopped. On April 18, 1943, the fundus of the right eye was described as follows: Margins of the disc are indistinct, with some edema

on April 18, 1943. The fundoscopic examination was repeated on April 25, 1943. It showed only indistinct disc margins in the right eye. The eye continued to be displaced down and out, with the action of the superior rectus absent.

X-ray films of the head were checked twice weekly and the amount of the gas in the cavity and the size of the cavity were seen to decrease gradually. On May 13, 1943, no air was observable (fig. 2). The fundi were negative. The blood count gradually returned to normal. The function of the superior rectus returned.

The neurosurgical service was not convinced that the lesion had been a brain abscess and discharged the patient with the following diagnoses: 1. Puncture wound of the roof of the right orbit. 2. Pneumo-encephalocele (traumatic). 3. Brain abscess suspect.

### DISCUSSION

The absence of neurologic signs in this case brings out the well-known fact that the frontal lobe is the "silent area" of the brain and emphasizes the tolerance this area has for trauma. This is especially true of that portion of the lobe opposite Broca's area.

The presence of gas could be accounted for in three ways:

1. Air introduced into the wound at the time of the injury. This is hard to suppose in that the volume of air was so great.

2. The air could have been forced into the frontal lobe along a channel from the paranasal sinuses, which the instrument penetrated on its way into cortical tissue; but X-ray studies showed no frontal nor ethmoid sinuses on that side. The localization of the puncture wound was lateral to the midline; that is, away from the sinus area.

3. Gas accumulating from gas-forming bacilli in the frontal lobe. The gas infection could have been established in one of the following ways: implantation directly into cortical tissue by the penetrating instrument, or extension from adjacent tissue along blood vessels, or directly through barriers. If the extension was by tissue spread, more superficial infection should have been observable. Grant,<sup>1</sup> in his review of brain abscess, states that an abscess rarely occurs unless the dura is penetrated. Later he states a brain abscess forms relatively rapidly after penetrating injury. The abscess here was well

established 20 days after injury, when X-ray evidence was obtained of the abscess. It was undoubtedly formed earlier, as compared to the time element in Tuffier's and Guillian's<sup>2</sup> series.

The most logical reason for the presence of air in the frontal lobe is that it was inoculated by direct implantation, the bacillus having been introduced with the pencil. Thus a colony of the organisms could have been planted deep in cortical material or an infected tract left to the gas-containing cavity communicating with the skin surface.

In Bagley's<sup>3</sup> review of brain abscess containing gas where cultures were obtained, the causative agent was *Clostridium aerogenes capsulatum*. However, in the majority of his cases only clinical evidence of gas-forming bacillus infection was obtained, which was also the situation in this case. Gas was obtained from the lid wound on one occasion, although the lid had been opened three days previously and was reopened daily. This would indicate the formation of gas in the orbital tissue, or else the gas passed down a patent tract from the gas-containing area to drain on the skin surface. The odor and consistence of the drainage material would not suggest a gas-forming bacillus infection, however.

The localization of this abscess by X-ray examination would place it below the cortex, or starting there and thinning the cortex over it (fig. 1). Atkinson<sup>4</sup> states that a brain abscess forms just below the cortex in the flat sheet of white matter, which is a relatively avascular zone. In the case of a penetrating wound the tract is cut off from the underlying abscess by the cortex with its relatively good blood supply. The possibility, however, of a communicating channel or tract between abscess and the drainage incision must be considered. The fact that gas was seen

coming from the wound on one occasion only, and that the amount of drainage of purulent material was out of proportion to the apparent lid involvement would seem to establish the existence of a tract which could have been cut off later in the course of the disease.

Symptoms in this case were minimal, the ocular signs of brain abscess present here were only minimal blurring of the disc margins and some venous engorgement in the right eye. Benedict<sup>5</sup> states that this is infrequent and does not always occur on the side of the lesion. Other ocular signs of frontal-lobe abscess—such as, swelling of the lids, chemosis of the conjunctiva, pain about the eye, exophthalmos—were of no value here as the orbital infection complicated the pic-

ture. There was no abducens paresis. Visual fields were not taken, for the patient could not coöperate.

#### SUMMARY

This case of pneumo-encephalocoele, discovered only by radiographic studies, indicates the possibilities of deeper injuries following puncture wounds of the orbital region. This marks the orbital plate as a particularly vulnerable area. The origin of the gas within the cranial vault is questionable, but could be answered by gas-forming organisms planted in cortical tissue through the orbital plate by the pencil on which the child fell. The rapid recovery and lack of symptoms were outstanding features of this case.

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# OPHTHALMOPLEGIA AND RETINAL DEGENERATION

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A number of authors have reported diverse neurologic changes associated with various forms of retinal degeneration. This association is most frequently seen in cases of cerebromacular degeneration or amaurotic familial idiocy, the juvenile form of which was described by Spielmeyer-Vogt. In these cases the pigmentary degeneration (retinitis pigmentosa) may be typical<sup>1, 2</sup> or atypical.<sup>3</sup> More rarely associated with pigmentary degeneration of the retina are progressive spastic paraplegia,<sup>4</sup> flaccid paraplegia with atrophy,<sup>5, 6</sup> variations of cerebello-pyramidal syndrome,<sup>7, 8, 9</sup> Friedreich's ataxia,<sup>10</sup> and progressive dementia.<sup>11, 12</sup> In all the reported cases more than one member of the family was affected. In the Laurence-Moon-Biedel syndrome, which includes pigmentary degeneration of the retina,<sup>13</sup> the patients involved in the original cases reported by Laurence and Moon later developed paraplegia.<sup>14</sup> There are, however, no reports of ophthalmoplegia complicating cases of retinal degeneration.

Four cases of various types of retinal degeneration complicated by ophthalmoplegia have recently been seen by the authors. In all these cases various other factors—postthyroid state, syphilis, or microcephaly—were present which might possibly account for the ophthalmoplegia. Nevertheless, in these cases the association of ocular-muscle palsies and retinal degeneration appeared to be more than a coincidence and suggested the possibility that degeneration in the retina and in the nerves to the extraocular muscles may be a syndrome due to some common factor.

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The four cases are, in brief, as follows:

*Case 1.*<sup>15</sup> K. P., a white woman, aged 43 years, had at the age of 5 years developed a left facial paralysis and internal squint following convulsions. At the age of 33 years her vision began to fail in both eyes. At 34 a thyroidectomy was performed, following which some questionable proptosis of the left eye was observed. When seen three years later there was partial limitation of all movement of the right eye and limitation of downward movement of the left eye. There was no exophthalmos at this time, although the lid fissures were abnormally wide and there was a lid-lag. Lenticular opacities prevented study of the fundi. Her vision was 1/200 in the right eye and light perception above only in the left eye. The cataract was removed from the right eye and the fundus showed a pale optic disc, narrow retinal arteries, and numerous deposits of pigment throughout the fundus, giving a typical picture of retinitis pigmentosa.

*Case 2.* G. F., a colored woman, aged 31 years, was known to have had a positive serologic test for syphilis for six years. She received, little, if any treatment. After a normal delivery at the age of 29 years, she had a series of major convulsions which left her with mild pyramidal signs. Positive blood and spinal-fluid serologic tests for syphilis were obtained, but she received no antiluetic therapy. Nine months later she was admitted to the psychopathic division of the Baltimore City Hospitals in acute mania. Her eye movements could not be adequately tested, but there was a divergent strabismus. Malaria therapy was given, the evidences of paresis cleared, and the serologic tests returned to normal. About one



year later she was readmitted to the Baltimore City Hospitals because of stomatitis. She had no more convulsions and was clear mentally. Serologic tests were negative. Her vision had been decreasing, and she had had diplopia on reading for the past year.

There was bilateral external ophthalmoplegia, complete except for the superior-oblique muscles supplied by the fourth cranial nerve. There was a slight downward motion of the eyes bilaterally but no voluntary motion upward. Bell's phenomenon, however, was present. At rest there was a bilateral ptosis. The pupils were equal, round, and regular, and reacted to light and accommodation. The left pupil dilated on looking to the left forcefully. Convergence was poorly performed.

Near vision was normal. Visual fields were normal to finger test, but the patient did not report to the eye clinic for accurate measurements of fields and vision. The optic disc and vessels were normal. The retina was normal except in the extreme periphery where there were numerous scattered corpuscularlike deposits of pigment.

The remainder of the neurologic examination revealed no abnormalities. Injection of prostigmine produced no change.

*Case 3.* E. R., a colored woman, aged 18 years, was admitted to the Johns Hopkins Hospital in 1935, complaining of having had difficulty in walking for three months. Except for one uncle, who died at the age of 58 years, having been blind and unable to walk for one year, the family history was noncontributory.

One year previous to this admission she had had a labial sore, and three months previously she had a positive serologic test for syphilis and received a single intravenous injection. From that period on she had increasing night blindness,

thickness of speech, difficulty in walking, with stumbling, and clumsiness of the hands.

There were partial bilateral sixth- and third-nerve palsies, slight right facial weakness, spasticity of the legs, unsteady gait, slight dysdiadochokinesis, and past pointing. Increased deep reflexes and patellar clonus were found on the left, and there was a bilateral Babinski reaction. A roentgenogram of the skull showed some atrophy of the cranial bones. The fundi were normal except for slight narrowing of the retinal vessels. Visual fields showed a small central scotoma on each side. Vision was 20/70 in each eye.

Antiluetic therapy was given from 1935 to 1937, when she disappeared from observation and received no further treatment. At no time was a positive serologic test for syphilis found in the spinal fluid. From 1937 on she had increasing difficulty with her gait until her admission in October, 1941, when she could not walk at all. In July, 1941, her vision began to decrease and her speech became increasingly labored and indistinct.

On admission, in 1941, her general physical examination was normal. There was bilateral optic atrophy. The vessels of the retina were extremely narrow and atrophic. The macula was the site of extreme degeneration bilaterally, and there was a hole in the center of each area of degeneration. The entire retina appeared atrophic, having a greenish fluorescent sheen due to diffuse fine pigmentary stippling. In the extreme periphery, a few heavy deposits of pigment were seen. Vision was reduced to light perception in each eye. The pupils were dilated and reacted to light slowly and incompletely.

There was no movement of either eye in any direction, either on voluntary effort, in response to caloric stimulation of the vestibular apparatus, or on Bell's

maneuver. The left eye looked forward, the right eye down and outward.

There was slight weakness and marked spasticity of all four limbs. There were no involuntary movements, fibrillations, or muscular atrophy. No ataxia was elicited on heel-to-knee, or finger-to-nose tests. Speech was slow, monotonous, and labored. No sensory disturbances could be found. All deep reflexes were hyperactive, and there was a bilateral Babinski response. She appeared retarded mentally. Later she developed bilateral atrophy and fibrillation of the tongue.

Blood, urine, and spinal-fluid examinations, including serologic tests for syphilis, were normal. A bromsulphalein liver-function test was well within normal limits.

*Case. 4.<sup>16</sup>* This 31-year-old white man came to the Out-Patient Department of the Johns Hopkins Hospital complaining of inability to raise his eyelids or to move his eyes. He also complained of a speech defect and deafness. There was no family history of mental or developmental defects nor of eye lesions of any nature.

Except for measles, his childhood had been healthy. Following a tonsillectomy at the age of 12 years, it was noticed that the patient was hard of hearing and had some decrease in vision, and he was taken from school. These signs gradually increased. At the age of 14, his speech began to be defective; and at the age of 27, he began to develop bilateral ptosis. About a year later, ataxia developed. He was admitted to the Hospital for study.

The general physical examination was normal. Neurologic examination showed the patient to be poorly developed, with a slender bony structure. The head was microcephalic with a high vertex. Vision was 6/50 without correction. The retinas were described as atrophic. The pupils were large and reacted sluggishly to light.

There was bilateral ptosis and loss of all ocular movements. The patient had severe, bilateral nerve deafness. The rest of the cranial nerves were intact. There was no muscular atrophy. There was oscillation of the head and trunk, with cerebellar ataxia in the arms and legs. Speech was indistinct and slow. There was no sensory loss. The tendon reflexes were all active and equal, abdominal reflexes were active, plantar responses flexor, and there was no clonus nor Hoffmann's reflex.

External examination of the eyes revealed a partial bilateral ptosis. The ocular movements were limited to excursions of about 4 degrees in each direction, and convergence was absent. The lacrimal apparatus, conjunctivas, and corneas were normal. The pupils were equal, and the pupillary reactions to direct and consensual light and to accommodation were normal.

In the right eye, the disc appeared of good color, but was surrounded by a whitish ring about one-fourth disc diameter across, with a very slight pigmentary disturbance. There was a generalized diffuse degeneration throughout most of the retina, most marked in the macular regions, consisting of a stippled appearance with fine pigmentary disturbance. In the far periphery, there was a general lack of retinal pigment so that the choroidal vessels were plainly seen. The retinal vessels appeared essentially normal.

Slitlamp examination and tension were normal.

Vision in the right eye was 10/200, in the left eye, 20/50—2.

Nose-and-throat examination showed that the levator muscles of the palate were paralyzed. There was a severe nerve type of deafness and negative vestibular response. Roentgenograms of the sinuses, optic foramina, and sella turcica were normal. The pineal was calcified. Blood

counts, urinalysis, and blood serology were all normal. No examination was made of the spinal fluid. Head measurements indicated dolichocephaly.

The patient was discharged with a diagnosis of progressive nuclear ophthalmoplegia; bilateral ptosis; nerve-type deafness; severe paralysis of levator muscles of palate; negative vestibular response; cerebellar ataxia, and retinal degeneration. He did not return for further examination.

## SUMMARY AND CONCLUSIONS

Four cases of various types of retinal degeneration with complicating ophthalmoplegia are reported. Although other factors were present which might account for the ophthalmoplegia, it was felt that the association is more than a coincidence. It is suggested that the two constant features in these cases, ophthalmoplegia and retinal degeneration, with secondary pigmentary changes may be a syndrome due to some common etiologic factor.

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# THE USE OF DORYL IN GLAUCOMA

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For a number of years the writer tried using doryl in an aqueous solution in the treatment of glaucoma, but with unpredictable results. After hearing a paper by O'Brien and Swan, given before the American Ophthalmological Society in 1941, in which they showed good results by using doryl in the surface-tension-reducing agent, zephiran, he began using doryl 1.5 percent in zephiran .03 percent, as advised by these authors.

No attempt will be made here to give the chemical formula or physiologic action of doryl, for this is covered fully in the paper cited.

All of the present writer's cases in which doryl was used were those which did not respond well to the usual glaucoma treatment, for some reason or other. Results obtained in such cases should be doubly valuable. It was used in many more cases than those here cited, but these few are the ones which came readily to mind. With the Schiötz tonometer used, any tension of 25 mm. Hg is at the upper limit of normal.

*Case 1.* Miss C. D., aged 64 years, was first seen on June 15, 1940, because of chronic, simple glaucoma in each eye. Tension, right eye, was 30 mm. Hg; left eye 40 mm. Hg. The discs showed glaucomatous cupping and the left eye showed a well-marked field defect. Pilocarpine in oil, 2 percent, and eserine in oil, 1 percent, each three times a day alternating, were prescribed, but the tension was always at or above the upper limit of normal. In July, 1941, the patient was placed on doryl, 1.5 percent four times daily, and all other drops were omitted. The tension came down to well within normal limits and has remained so.

*Case 2.* A. C. M., aged 64 years, was first seen in June, 1936. He had been under the care of another oculist for glaucoma and was using pilocarpine several times daily. The pupils were of pinpoint size, but in spite of this the tension was 35 mm. Hg each eye. Both eyes showed cataractous lens changes and the best vision with correction was right eye 20/100, left eye 20/60. With pilocarpine, 1 percent twice daily, and eserine in oil, 1 percent twice daily, the tension remained between 30 and 35 mm. Hg in each eye. In October, 1936, a glaucoma operation was performed on the left eye, and the tension has remained well under control ever since. The tension of the right eye remained above 30 mm. Hg. This eye was operated on for glaucoma in December, 1936. Following the glaucoma operation on the right eye, the tension was reduced for a short while and then returned to the former level. One year later the right eye was again operated on for glaucoma, following which the tension remained normal for a short while and again went to 35-40 mm. Hg, and could not be controlled by any remedies tried, including epinephrine bitartrate. On two subsequent occasions this eye had further glaucoma operations, none of which gave relief. In March, 1939, a cataract extraction was performed in the hope that this would relieve the tension, but it did not. The tension remained around 55 mm. Hg, and the eye was gradually deteriorating. In July, 1941, the patient was placed on doryl, 1.5 percent. The tension was reduced from 55 to 30 mm. Hg, but the doryl caused so much discomfort its use could not be continued.

*Case 3.* E. F. M., a man, aged 82 years, was first seen on October 7, 1942. He had

glaucoma simplex. Tension O.D. was 35 mm. Hg, O.S. 40 mm. Hg. He was given pilocarpine, 1 percent, to be used four times daily. Under this regimen the tension of the right eye was brought down to 30 mm. Hg, while that in the left eye remained at 40 mm. Hg. The patient did not come in regularly, but in spite of the administration of pilocarpine, 1 percent four times daily, the tension remained 30 mm. Hg in the right eye and 40 mm. Hg in the left eye, until June, 1943. Eserine was applied but had to be discontinued because of the discomfort it produced. On June 16, 1943, doryl, 1.5 percent, was instilled in the left eye, and the tension, which had been 40 mm. Hg, promptly fell to 20 mm. Hg. Doryl, 1.5 percent, was ordered to be used twice daily in each eye along with the pilocarpine, 1 percent, twice daily, in each eye. The tension has remained at 22 mm. Hg in the right eye and 25-27 mm. Hg in the left eye ever since.

*Case 4.* Mrs. W. D. W., aged 50 years, was first seen on December 11, 1942, because of lid trouble. The optic discs were found to be cupped, and the vessels were pushed to the nasal side. Intraocular tension was right eye 35 mm. Hg, left eye 30 mm. Hg. Pilocarpine, 1 percent, was prescribed, to be used four times daily in the right eye and twice daily in the left eye. In spite of this the tension remained at slightly above 30 mm. Hg in the right eye and 25-27 mm. Hg in the left eye. On June 4, 1943, doryl, 1.5 percent, was applied to the right eye, and the tension fell from 30 to 25 mm. Hg. The patient was given doryl, 1.5 percent, to be used twice daily in the right eye, in addition to pilocarpine, 1 percent, twice daily. She complained some of blurring of vision in the right eye after the use of doryl, but the tension has remained at 20 mm. Hg since the use of doryl was initiated.

*Case 5.* E. F. D., a man, aged 81 years,

was first seen on May 27, 1941, because of a chronic, low-grade glaucoma which, from the history, evidently became worse at times. He was put on pilocarpine and not seen again until July 1, 1941. Then he was seen in the hospital because of an injury to his back suffered in a fall. He had developed congestive glaucoma in the left eye with steamy cornea, dilated pupil, and tension of 60 mm. Hg. This congestive glaucoma responded well to treatment within a few hours, but on July 6th, five days later, he developed congestive glaucoma in both eyes with a tension of 80 mm. Hg, in each eye. Both eyes again responded well to treatment and returned to their former noncongestive glaucomatous condition. Since then the tension of the right eye has remained within normal limits under pilocarpine therapy, 1 percent, but the tension in the left eye has remained at 50 mm. Hg. On October 30, 1943, the tension in the left eye was 55 mm. Hg. Doryl, 1.5 percent, was used and reduced the tension to 30 mm. Hg within an hour; the first time it had been below 50 mm. Hg in a year. The patient was given doryl, 1.5 percent, to be used in the left eye twice daily and all other miotics were to be omitted in this eye. He continued the pilocarpine, 1 percent, twice a day, in the right eye. When next seen on November 19th, practically three weeks later, the tension was 22 mm. Hg in each eye.

*Case 6.* Miss M. F. S., aged 71 years, was first seen on July 5, 1933. Intraocular pressure was slightly over 30 mm. Hg right and left, and the form fields were defective. With pilocarpine, 1 percent twice daily, the tension remained well within normal limits. After continued use of the pilocarpine, she developed marked lid irritation. Eserine, 0.5 percent, was substituted for the pilocarpine and maintained normal tension, but this also soon gave rise to marked lid irritation. In Au-

gust, 1943, doryl, 1.5 percent, was substituted for the eserine and the pilocarpine, and maintained the tension at 20 mm. Hg in each eye when used once daily. The lid irritation cleared rapidly and the patient was quite happy with this new medication. In September, 1943, doryl was unobtainable at the local pharmacies, so the patient went without a miotic for several days. When she returned, ocular tension was from 30 to 35 mm. Hg in each eye. Pilocarpine, 1 percent, was resumed and maintained normal tension but soon had to be stopped because of extreme lid irritation. Doryl again being available, it was resumed on October 30th and has maintained normal tension in each eye. There has been no lid irritation.

*Case 7.* Mrs. C. B., aged 45 years, was first seen in 1930 because of cataracts and old vascularization of the corneas as from old interstitial keratitis. She gave a history of blindness in early life. Blood tests were negative. In 1931 a cataract extraction was performed on the right eye. Some time later the patient developed noncongestive glaucoma in the right eye which was controlled by miotics for some time. However, in April and May, 1943, the tension remained up to 40 mm. Hg in spite of the use of pilocarpine in oil, 2 percent, and eserine in oil, 1 percent, each applied three times daily. On May 18th, the tension was 35 mm. Hg. Doryl, 1.5 percent, was used, and within 40 minutes the tension was reduced to 22 mm. Hg. This was now ordered to be used night and morning in addition to pilocarpine, 1 percent in oil, twice daily. Since then the tension in the right eye has remained at 22 mm. Hg.

*Case 8.* J. H. H., a man, aged 64 years, was first seen on April 22, 1943, because of chronic, simple glaucoma, right eye, and absolute glaucoma in the left eye, with no light perception in the latter. Tension

was 55 mm. Hg in the right eye; in the left it was too high to be measured. Under pilocarpine, 1 percent, and eserine 1 percent, each applied twice daily, the tension of the right eye was reduced to range between 30 and 35 mm. Hg, while the left eye was not influenced. Doryl, 1.5 percent, was used in each eye and brought the tension of the right eye down to 22 mm. Hg and of the left down to 60 mm. Hg. However, doryl caused exquisite pain in the eyes and even syncope; it was therefore discontinued.

*Case 9.* Miss N. M., aged 57 years, was first seen in March, 1941, for refraction. She was found to be suffering from chronic, simple glaucoma with the intraocular pressure in the right eye 27 mm. Hg, in the left eye 30 mm. Hg. Under pilocarpine, 1 percent, twice daily, the tension came down to normal and with correction her vision was 20/20, each eye. This patient was not seen again until September of 1943, two-and-one-half years later. At this time the vision was still 20/20 in the right eye but down to 20/75 in the left eye with best correction. She had used no drops of any kind for a long time. The intraocular pressure was right eye 30 mm. Hg, left eye 70 mm. Hg. With pilocarpine, 1 percent, twice daily in the right eye and four times daily in the left eye, the tension came down to right eye 25 mm. Hg, left eye 35 mm. Hg. Eserine, 1 percent, was ordered to be used twice daily in the left eye in addition to the pilocarpine, 1 percent, twice daily. With this medication the tension of the left eye still remained at 30 mm. Hg, or above. On November 8th, doryl, 1.5 percent, was ordered to be used twice daily in the left eye, replacing the eserine oil, and the pilocarpine, 1 percent, was continued twice daily. Ten days later the tension in the left eye was down to 25 mm. Hg.

From the foregoing cases, it can be seen that doryl is not effective in all cases of glaucoma and in some cases is even contraindicated. However, from the writer's experience in these and many other cases

not cited, it would appear that doryl when used in the surface-tension-reducing agent, zephiran, is a valuable adjuvant in the treatment of glaucoma.

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## KERATOCONJUNCTIVITIS CAUSED BY THE MANZANILLO TREE\*

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The reaction of the eye from contact with the manzanillo (beach apple) tree has been noted in the Caribbean area for a number of years.

In the days of the early Spaniards, it was supposed to have caused "blindness,"

made it imperative that they all be given warning of the toxic nature of the beach apple tree.

*Hippomane mancinella* L. (Euphorbiaceae) is an attractive, round-topped tree, averaging 15 to 25 feet in height,



FIG. 1 and 2 (Harley). The manzanillo tree. FIG. 1. A manzanillo tree on a sea beach in Panama. FIG. 2. The fruit of the manzanillo or beach apple.

and this belief is yet extant, especially among a large native population in this area. Although the inhabitants who are in the vicinity of the manzanillo are quite aware of the toxic effect of the plant, certain circumstances have reawakened interest in this problem. The large number of troops, many of whom are stationed near these poisonous trees, has

common to the sea beaches of Central America, the northern coasts of South America, the West Indies, and Florida. The small green fruit, about an inch in diameter, looks not unlike the crabapple of North America. The leaves resemble those of a cherry tree, and the flowers are green and arranged in stiff spikes (figs. 1 and 2).

\* The manzanillo is also known as the beach apple in Panama and as the manchineal in Jamaica and Trinidad.

The leaves and branches when broken exude a milky latex which is extremely irritating to the mucous membranes and



skin,<sup>†</sup> causing a marked inflammation and vesiculation similar to that produced by *Rhus toxicodendron*. The conjunctiva appears particularly vulnerable to this toxic latex, and the severe keratoconjunctivitis thus produced causes such blepharospasm that it is commonly referred to as "blindness."

Seeman, in his recording of the voyage of H.M.S. *Herald*, states that some of the ship's carpenters were blinded temporarily by the sap getting into their eyes while cutting down some of the trees.<sup>1</sup> Richard Ligon also, in "A true and exact history of the Island of Barbados" (1673), says of the cutting of the trees: "The fellers as they cut them down are very careful of their eyes and those that have Cipers put them over their faces, for if any of the sap fly into their eyes they become blind for a month."<sup>2</sup>

There is evidence that a heavy dew will bring the toxic sap from the branches to the exposed parts of anyone beneath the tree.

Recently some troops on night maneuvers, having completed their mission, fell asleep beneath the sheltering trees of the beach. Within a few hours many were awakened by a burning about their eyes and faces. Sixty men had to be hospitalized because of the severity of the reaction but all recovered completely (Satulsky<sup>3</sup>).

#### CLINICAL FEATURES

Four cases of acute keratoconjunctivitis resulting from contact with the manzanillo tree have been seen at Gorgas Hospital in the past year. In each case there was an accompanying dermatitis venenata chiefly distributed to the face, arms, trunk, and the penis (which had

been contaminated during the act of mic-turition).

The ocular findings in manzanillo poisoning are similar to any severe contact keratoconjunctivitis. The patient invariably gives a history of bodily contact with the tree. By careful questioning and a knowledge of the predilection of these trees for sea beaches, a positive identification of the beach apple tree can be made. Burning, lacrimation, and some blepharospasm are noticed from a few minutes to an hour following contact. The eye symptoms rapidly develop into frank pain and total inability to keep the lids open or even to allow the lids to be manually opened. The dermatitis does not become evident until a few hours later.

The patients are characteristically led into the office with both eyelids tightly closed, lacrimating profusely, and in obvious pain. The eyelids are often markedly edematous and may present some form of vesicular eruption on the thin skin surface. In severe cases, a tongue of red, edematous or even chemotic conjunctiva may appear between the eyelids. Fluorescein stain will show that the corneal epithelium and scattered areas of the conjunctival epithelium are denuded. The vision is reduced in proportion to the extent of the damaged corneal epithelium. The remainder of the ocular examination shows nothing else of pathologic importance. With the exception of the irregularly distributed dermatitis, the general physical examination is negative. The routine laboratory tests show a rather persistent eosinophilia, but are otherwise negative.

The treatment of the keratoconjunctivitis is directed toward making the patient as comfortable as possible, preventing infection, and waiting for the cornea to reëpithelize in its normal fashion.

A 0.5-percent solution of pontocaine or

<sup>†</sup> The active principle of the poison in the sap of the manzanillo tree has not been ascertained.

pontocaine ointment is particularly effective as an anesthetic and its application should be the first step in the treatment after the history of contact with the vegetable irritant has been ascertained.

After the patient has thus been given some measure of relief, the conjunctival sac is irrigated with copious quantities of normal saline solution. Bed rest, cold boric-acid compresses for the lids and conjunctival edema, and enough pontocaine ointment to keep the patient reasonably comfortable make up the remainder of the treatment for the eyes. Although, the patient's eyes feel comfortable within a relatively short time, it has been observed that the cornea takes the fluorescein stain up to five or seven days after the initial contact. The original vision is restored at this time. Corneal ulcers have been observed to persist in certain neglected cases.<sup>4</sup>

The dermatitis can be satisfactorily treated with boric-acid compresses for the face and calamine lotion for the rest of the involved skin. The dermatitis venenata is usually cleared up about the same time that the eyes have healed.

#### EXPERIMENTAL WORK\*

In an attempt to study the toxic agent of the manzanillo tree, a series of skin tests was tried in an endeavor to find: first, the most toxic part of the tree; and, second, the most effective means of eradicating the toxin once it has been contacted.

For the first problem, 14 individuals were each patch tested with the leaf, the peelings of the fruit, and the sap. It was easily determined that by far the preponderance of toxicity is resident in the sap, although in a few cases the peelings like-

wise produced a maximum blister. It was thought that the latter had possibly been contaminated by the sap.

In regard to the second problem, another series of skin tests was made in which the sap alone was used. After the sap had remained in contact with the skin for one-half hour, it was removed by ether, soap and water, sea water, or lime juice.<sup>†</sup> One area in each case was left untreated and acted as a control. These prophylactic agents were found to be effective in the order named.

For many years it has been known that there is a simple and effective remedy always at hand; that is, sea water. Our results confirmed the efficacy of sea water as a prophylaxis, but, in addition, it was seen that ordinary soap and water is even more effective in removing the sap from the skin.

The toxic effect of manzanillo sap on the rabbit's eye was then studied. A small drop of the fresh sap was instilled into the superior cul-de-sac of the normal eye of a white rabbit. Mild blepharospasm and photophobia were noted within 60 seconds. Conjunctival injection and chemosis were pronounced at the end of one-half hour. At the end of five hours, a maximum effect was produced, consisting of marked blepharospasm, lacrimation, conjunctival redness, and chemosis extending on to the nictitating membrane. A thick mucopurulent discharge was noted. Fluorescein stain showed scattered areas of denudation on the upper conjunctiva and cornea. Within 24 hours, the conjunctival reaction had nearly subsided except for a residuum of lacrimation and conjunctival injection. At the end of 48 hours the eye appeared completely well.

Having obtained a satisfactory control

\* The experimental work was done in conjunction with James S. Snow of the Dermatology Department and the details of the experiments will appear in another publication dealing more fully with the dermatologic aspects of manzanillo poisoning.

† Lime juice is a native remedy for ocular involvement.

on the toxic effects of the sap, we entered upon another experiment, to ascertain the expediency of saline irrigations as a prophylactic agent following contact with the beach apple.

A second healthy rabbit's eye was selected for the sap instillation. Fifteen minutes following the instillation, the affected eye was irrigated with 4 ounces of normal saline solution. The eye was observed every 15 minutes for one hour and then five hours later. The resulting keratoconjunctivitis was in every respect the same as that of the eye which had not been irrigated with saline.

A drop of the toxic sap was then instilled into a third healthy eye. This eye was irrigated with 4 ounces of normal saline solution five minutes following the topical application of the sap. At the end of five hours, the eye showed a mild keratoconjunctivitis with a few superficial staining areas on the cornea. In 24 hours the eye was normal except for a slight conjunctival injection in the superior fornix. This eye showed less reaction than the control and was well in 24 hours instead of in 48 hours.

We conclude, therefore, that saline irrigations as a prophylaxis at the end of five minutes' exposure will reduce but not prevent the keratoconjunctivitis resulting from the sap of the manzanillo tree. In the rabbit's eye the healing period was reduced by about one half.

It is our opinion, based on studies with this vegetable irritant, that prompt and re-

peated immersion in the nearby sea water with lids open will mollify, if not wholly eradicate, the toxic effects of manzanillo sap in the eyes. This procedure offers the best form of first aid until medical aid can be obtained.

#### SUMMARY

1. A severe keratoconjunctivitis and dermatitis result from the irritating action of the manzanillo or beach apple tree common to the sea beaches in the Caribbean area.

2. Blepharospasm, conjunctival edema, and denudation of the conjunctival and corneal epithelium are the most characteristic findings.

3. Treatment for the eyes consists of saline irrigations, cold compresses, anesthetic instillations, and ocular rest. The dermatitis responds to bland wet dressings and calamine lotion.

4. Patch tests showed that the sap of the tree possesses the most irritative qualities. Sea water and soap and water for the skin are the most effective, practical, and immediate means at hand of combating the irritant.

5. Experiments on a rabbit's eye showed that the toxic action of the sap could be modified by the prompt use of saline irrigations.

6. Recommended prophylactic measures consist of bathing in sea water with the lids open, followed by a thorough cleansing of the skin with soap and water.

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# ACTINIC KERATOCONJUNCTIVITIS\*

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The acute inflammatory reaction of the superficial parts of the eye to short-waved light, called *photophthalmia* by Parsons in 1913, has been known and recorded since early times. Xenophon<sup>1</sup> in his "Anabasis" mentioned one of its forms—snow blindness. The best-known form today is the so-called *flash burn* of the eyes, usually a result of exposure to the welder's arc. We should like to suggest a routine of therapy in such cases and comment particularly upon the use of adrenalin as a means of markedly decreasing the duration and severity of symptoms.

## ETIOLOGY

Histaminelike substances are products of normal cellular metabolism. They dilate minute vessels and thereby direct blood preferentially to those parts where metabolism is most active and the needs of nutrition therefore greatest.

Antagonists of these histaminelike substances (hereinafter referred to as histamine) are adrenalin and pituitrin. The action of the latter (vasoconstriction) is less powerful than that of the histamine (vasodilation). The complete reaction produced by histamine is three-fold, the *triple response* of Lewis:<sup>2</sup> (1) primary

and local dilation of minute vessels; (2) local increase in permeability of capillary walls; (3) widespread dilation of neighboring arterioles. The triple response is brought about by a local nervous reflex. The complete triple response is elicited after any trauma which is sufficient to liberate histamine from the cells. The output of histamine seems to be controlled by impulses *descending* the sensory nerves (antidromically), presumably because these nerves control the actual metabolism of the cells.

Radiant energy (heat, light, ultra-violet) dilates capillaries through the same mechanism, histamine being liberated by the direct action of the radiation. *After* the liberation of histamine has produced a *well-marked* vasodilation with an increased capillary permeability, any attempt to constrict the blood vessels is quite without effect; this state is termed one of *unresponsiveness*.

As elsewhere in the physical world, so in the eye—it is only the rays that are *absorbed* that can exert any effect upon the substances they traverse (Draper's law); those that are reflected or transmitted can have no action, deleterious or otherwise, upon them. Light that is absorbed may produce any or all of three effects: (1) thermal effect, (2) abiotic effect, and (3) fluorescence. We shall concern ourselves primarily with the second of these; that is, the abiotic or photochemical effect.

For practical clinical purposes, it has been found that only rays shorter than 3,000 A.U. may be considered abiotically active. The reaction comes on after a

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latent period of 8 to 12 hours, varying with the intensity of exposure. It is found, as might be expected, that the cornea is especially sensitive to ultraviolet light. It is sensitive not only because of its absorption but also because of its rich supply of nerve endings which, incidentally, are peculiar to the eye.

Widmark<sup>3</sup> in 1889, using rabbit eyes and a 1,200 candle-power arc, produced a typical photophthalmic reaction (that is, an acute conjunctivitis with chemosis and a purulent secretion, a desquamation of corneal epithelium—and, with stronger doses, formation of corneal opacity, miosis, and iris discoloration).

Even a slight abiotic reaction over a large area of cornea is extremely painful. Such a reaction is the real basis of photophthalmia or snow blindness and may occur in typical form in flash burns of the eye following exposure to the welder's arc.

#### PATHOLOGY AND PHYSIOLOGY

It might be parenthetically stated here that the object of tissue irradiation is to produce a mild skin reaction that is accompanied by changes in the blood and in the tissues resembling in some ways those occurring in foreign-protein shock.

The histologic appearance of the fully developed reaction is characteristic. In the cornea, initially, there is nuclear chromolysis associated with a swelling and edema of the cytoplasm. Thereafter, acidophil staining becomes evident in the nucleus which progresses to the formation of highly refractive red granules within it; these coalesce into discrete "inclusion bodies," which may eventually replace the whole of the nucleus. Finally the inclusions may be extruded from the nucleus into the cytoplasm and thereafter the cell dies; if superficially located, it is desquamated.

Meanwhile, in the surrounding tissue

(conjunctiva), there is a considerable vascular reaction, the most interesting feature of which is an *eosinophilic* infiltration. Many nuclei of superficial cells take on a red stain, but no definite inclusions are formed. The superficial layers of tissue become largely swollen and many cells desquamate, leaving a rough, irregular surface. The subepithelial tissue shows much congestion and some chemosis and edema, while tiny interstitial hemorrhages and considerable *eosinophilic* and polymorphonuclear infiltration are evident. After mild exposures, the process may stop at any stage, and the cells return to normal in appearance and in staining reaction. Two features of the process of resolution are characteristic: (1) the rapidity of recovery of traumatized cells with proliferation of fresh cells to replace exfoliated ones; (2) the comparative absence of mitotic activity in the process of repair.

The actinic rays are absorbed into the protein molecule, producing photochemical changes of denaturation, in reality an acidophil degeneration. When the reaction is pushed to extremes, the result is coagulation of the proteins and eventual death of the cell. In the cornea, the reaction is seen most typically in the epithelium and to a lesser extent in the substantia propria. Any degree of change may occur and an opacity may be produced on severe exposure. Clinically, keratitis thus produced together with an associated conjunctivitis is *actinic keratoconjunctivitis*, photophthalmia, or snow blindness. The fact that the cornea itself absorbs most of the abiotically active rays greatly diminishes the severity of the action on the structures within the eye<sup>2</sup>

#### CLINICAL COURSE

Initially there is a latent period during which no effects are visible. It is interesting to note that between the end of this

latent period and the commencement of acute symptoms, at the time when corneal edema is very obvious, and when in the human subject typical halos<sup>4</sup> are most evident, the cornea becomes practically *anesthetic*! The latent period varies in length inversely as the severity of exposure, averaging 8 to 12 hours.

At the end of this time, there is noted a rapid onset of severe, sharp, continuous ocular pain, associated with profuse lacrimation, photophobia, and later with blepharospasm. At this time the cornea shows a slight irregularity of its reflex and a stippling of its surface which takes on a fluorescein stain. Even before the onset of corneal pain, the patient may experience a prickling sensation about the eye, may see halos about lights (due to corneal edema), and there is an erythema of the skin of the lids on the side involved. On the average, blondes seem more susceptible than brunettes.

The corneal-staining area gradually increases centrally, owing to desquamation of epithelium, but the edges of the area involved rarely show a well-defined margin. Meantime, in severe cases, the central part of the cornea becomes somewhat hazy and edematous, definite vesicles being occasionally formed under the epithelium; these rupture quickly, leaving punctate, densely staining areas. It is of interest that if a severe corneal infiltrate is produced, it is usually near the limbus, although invariably separated from it by a narrow zone of clear cornea.

Simultaneously with the development of the corneal haze, the conjunctiva becomes pink and hyperemic, the inflammation gradually increasing in intensity until it involves edema and chemosis and the appearance of a varying amount of secretion which eventually may become frankly purulent.

The iris is also affected. Apart from the iris irritation and spasm accompan-

ing any corneal infiltrate (resulting in miosis), severe flash burns produce a miosis which even atropine will not overcome for a time. There is evidence, in fact, to show that ultraviolet light acts *directly* on the iris musculature to produce miosis independent of that occurring as an irritative reflex. Superficial vessels in the iris stroma are dilated and small petechial hemorrhages may appear. An aqueous flare is present, but practically no cells appear in the anterior chamber.

The clinical picture is at its height in 36 to 54 hours after irradiation. Thereafter it gradually subsides until in four or five days the cornea becomes clear again, the conjunctival injection dies down, and the eye becomes normal in 8 to 10 days' time.

#### TREATMENT

We have utilized the following routine of therapy and feel that the results have been satisfactory. Once the diagnosis is made, the patient is rendered comfortable by the instillation of a corneal anesthetic; 0.5 percent pontocaine is a good, quick-acting one.

Following anesthesia, three instillations of 1:1,000 adrenalin at five-minute intervals are made; if the case is seen *soon after* the onset of ocular pain and *before* vascular congestion has reached a *maximum*, this is all that is necessary. That is, of course, provided the burn is not a particularly severe and deep one. Usually such patients gain immediate and frequently permanent relief, enabling them to return to work at once.

If vasodilation is marked when the patient first appears, the aforementioned routine is followed, and in addition the patient is given holocaine and epinephrin ophthalmic ointment to be used in the eye every three hours.

One valuable and early sign of a severe burn is a *miotic pupil*. One-percent atro-

pine ophthalmic ointment is always instilled, but several repetitions may be necessary before mydriasis is secured in severe cases.

In the more severe burns, or in those which are *not seen until 48 to 96 hours after the burn has occurred*, more drastic therapy may be indicated. Chemosis and a mucopurulent secretion in addition to palpebral edema are all a part of the entity of flash burn and are not on an infective basis. Cold packs and holocaine and epinephrin ointment are usually sufficient. Occasionally, a sedative is necessary.

Either corneal or conjunctival ulceration or both must be dealt with apart from the specific entity of flash burn. Corneal ulcers thus formed are very indolent and often discouragingly slow in healing. Chemical cauterization, intravenous typhoid, vitamin therapy (riboflavin and ascorbic acid), dionin, methylene-blue powder—all may be tried. As long as any corneal staining persists, it is our belief that the eye should be kept closed with an eye pad.

We claim no originality for the idea of the use of adrenalin in these cases, but at the same time we are unable to find it mentioned specifically in the literature and thus cannot give credit where credit is due.

Since in wartime the majority of flash-burn cases are in war workers, lost man-hours become an important consideration. If the course of the process can be in any way shortened, or, better still, aborted entirely, not only the patient as an individual but his employer as a wartime producer will be distinctly benefited.

## DISCUSSION

A brief reconsideration of the pathologic physiology of the flash burn will perhaps suggest possible justification for an otherwise empirical use of adrenalin. On the one hand, adrenalin is the most powerful antagonist of the histaminelike substances released in the tissues, a result of the irradiation. On the other hand, before vasodilation becomes well established (the state of unresponsiveness) the vessels will respond to adrenalin by vasoconstriction. Thus their tone is maintained, preventing circulatory stasis, with a consequent piling up of metabolites in the tissues, leading to further irritation, vasodilation, and edema.

Finally, the appearance of eosinophils in addition to the similarity of the tissue reaction to that in anaphylactic protein shock would, perhaps, indicate the use of adrenalin on purely theoretic grounds. At any rate it has been our clinical experience that early and prompt instillation of adrenalin has a distinctly beneficial effect in modifying the severity of the subsequent course of the flash burn.

## CONCLUSION AND SUMMARY

Actinic keratoconjunctivitis or flash burn is an important industrial disease, particularly in war time. Ultraviolet irradiation is the causative agent, producing an irritative and degenerative tissue reaction. Adrenalin instillations early in the clinical course of the condition will markedly reduce the severity or even abort the condition entirely.

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# CORRECTION OF EXTERNAL-RECTUS PARALYSIS WITH CONTRACTURE OF THE OPPOSING INTERNUS\*

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In time of war, certain casualties are seen more frequently than appear in periods of less violence. Palsies of the extraocular muscles can be expected to be more common today because of the increased incidence of head injuries resulting from mechanized combat. Most common of all extraocular-muscle paralyses is that involving the external-rectus muscle, causing diplopia and inability to rotate the eye temporally. As Bielschowsky<sup>1</sup> and others have pointed out, it is by far the most frequently paralyzed isolated muscle because the abducens nerve has a longer course along the base of the skull than have the other motor nerves of the eye and it happens to be more exposed, particularly where it crosses the apex of the petrosal part of the temporal bone.

There are numerous causes for abducens palsies besides trauma, some of which call for surgical correction. Rea<sup>2</sup> has made a convenient clinical classification:

1. Lesions of the orbit such as accompany cellulitis, sinusitis, abscess, neoplasm, exophthalmic goiter, gumma, trauma, and hemorrhage.
2. Lesions at the base of the brain between the sphenoidal fissure and the pons caused by syphilis, inflammations, toxins, or basal-skull fracture. Gradenigo's syndrome is the name used by otologists for external-rectus palsy associated with infection of the ear.
3. Lesions of the brain stem, either nuclear or fascicular, due to syphilis, hemorrhage, encephalitis, disseminated sclerosis, poliomyelitis, myasthenia gravis, alcohol, toxins, tumors.
4. Lesions of the cerebrum, some of which are congenital.

Where cases of congenital palsies have come to surgery, one has frequently found a rudimentary externus made up solely of fibrous bands, possibly including a few isolated muscle fibers.

Since Hummelsheim<sup>3</sup> proposed a method of transplanting slips of functioning muscles to replace paralyzed ones, it has been known that a surgical method existed to correct the deformity, but surgeons were slow to make use of the technique. O'Connor<sup>4</sup> reported on his modifications, and, since then, he as well as others like Gifford,<sup>5</sup> Peter,<sup>6</sup> and Wiener,<sup>7</sup> have further advanced their methods and reported on clinical results.

In recent years, then, there has been evidence of more uniformity in surgical technique but at the same time a growing concern about delay on the part of neurologists and general physicians in referring the cases to ophthalmologists for treatment. The feeling is growing that patients should be seen at frequent intervals following onset of the disturbance. Ocular rotations should be studied repeatedly with two points in mind: (1) the spontaneous improvement, if any, in the function of the externus; (2) the degree of spasm and contracture of the opposing internus. O'Connor<sup>8</sup> stated the contracture may be measured by grasping the conjunctiva with forceps, after a local anesthetic has been instilled, and rotating the eye temporally. He proposed that operation should not be delayed after the onset of contractures even though an insufficient time had elapsed in which to make certain that function would not return spontaneously. This feeling of urgency is in agreement with Bielschowsky's<sup>9</sup> that "orthophoria cannot be re-

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stored as soon as a paresis is cured if the paretic deviation is caused not only by the normal tonus of the intact muscles but by the secondary contracture of the antagonist of the paretic muscle due to a change of its structure."

Whether or not anything must be done to the internus, opposing the transplants to the externus, depends on the age, the amount of contracture of the internus, and the completeness of the external-rectus paralysis. In a fairly recent case, in which there is little or no contracture, it may be possible to leave the internus undisturbed. In cases exhibiting moderate degrees of contracture and considerable deviation, a central tenotomy judiciously used will allow the eye to straighten and still not weaken convergence. In some old cases of severe contracture and extreme nasal deviation nothing less than a recession of the internus will permit a cosmetic cure at the cost of weakening the convergence power. Often the cosmetic and functional results are remarkably good even after drastic procedures on the internus which were deemed necessary to straighten the eyes.

It is a basic principle that in muscle surgery the functional result be kept uppermost in mind. A cosmetic cure, while satisfying to the patient at first, may not be adequate when he assumes special tasks which place a greater burden on his eyes and a premium on binocular vision and good convergence. While agreeing wholeheartedly with this trend of thought, the writer believes that ophthalmologists should not offer too pessimistic a prognosis when faced with an old case in which contractures have already set in. The following instances from the Eye Clinic at Stanford are presented as examples of surgery undertaken despite handicaps which yet produced results both pleasing to the patients and encouraging to the surgeon.

Few ophthalmologists have had an opportunity to study early cases of abducens palsy in any significant numbers. Most of the reports deal with the surgical treatment of old cases. This has been partly due to a reluctance to recommend operation until the possibility of spontaneous cure is remote. Not only have the general physician and neurologist been at fault in this, but the ophthalmologist as well. It is to be hoped that in the armed services, with their excellent facilities and well-trained staffs, cases arising from war injuries will receive the close attention and prompt treatment which insure a good functional as well as cosmetic result. Even when we see a patient with a neglected external-rectus paralysis resulting in a disfiguring squint, we should not forget that muscle transplantation is still indicated. A purely cosmetic repair will mean a great deal to the patient, and if, in addition, a functional success is achieved, the operation will have been invaluable.

#### CASE REPORTS

CASE 1. F. T., a 58-year-old white female draftsman, was seen on July 30, 1942; her complaint was eye fatigue, and diplopia of 20 years' duration. The patient had noticed diplopia on looking to the right following an attack of influenza 20 years previously but the right eye was straight until two years before, when it started to deviate nasally. Vision was: R.E. and L.E. 20/25 uncorrected. There was an insignificant refractive error.

*Examination* of the eyes was negative except for the position and rotations of the right eye, which was deviated nasally 25 degrees in the primary position. It could not be rotated temporally beyond the midline. Secondary deviation of the left eye was extreme. There was no limitation of vertical rotation.

*Procedure.* Because of the moderate deviation and small degree of contracture

a central tenotomy was performed on the right internus in conjunction with an O'Connor cinch operation on the externus and transplantations of the nasal halves of the superior and inferior recti.

*Result.* For one week the right eye was 20 degrees divergent. In two weeks the patient had binocular vision and third-degree fusion. At the end of a month, she was able to rotate the eye 25 degrees externally and 30 degrees internally and soon returned to her drafting board. The patient has been in at intervals during the past year to recount that her diplopia is gone and she is able to carry on her war job without too much strain.

CASE 2. B. H., a 56-year-old white housewife seen on February 8, 1943; her complaint, diplopia following a head injury at the age of three years. Until two years before entry, left eye could be kept straight with effort but since then it had turned in more and more. Vision, corrected, was: R.E. 20/25; L.E. 20/50. There was an insignificant refractive error.

*Examination.* The eyes were normal except for 50 degrees of esotropia in the left eye. This eye could be rotated temporally within 10 degrees of the midline. Elevation and depression were unimpaired.

*Procedure.* Because of the marked deviation and evidence of contracture, a 3-mm. recession was performed on the left internus in conjunction with an O'Connor cinch operation on the externus and transplantations of the nasal halves of the superior and inferior recti.

*Result.* After two weeks the eyes were straight, diplopia appearing only on looking far to the left. After six months, the patient had binocular vision, no complaint of diplopia, and rotations of 25 degrees in each direction. Under cover, the patient had a hyperphoria of the left eye, which did not cause symptoms, for she did a

great deal of reading and sewing without complaint.

CASE 3. D. K., an 11-year-old white male, was seen on July 10, 1934. He had had cross-eyes since birth. Vision with glasses was: R.E. 20/200; L.E. 20/25. Under atropine retinoscopy the following correction was indicated: R.E. +5.00D. sph.  $\approx$  +0.50D. cyl. ax. 90°; L.E. +2.25D. sph.  $\approx$  +0.75D. cyl. ax. 90°.

*Examination* was essentially negative except for the ocular rotations. The patient fixated with the left eye, and the right eye turned in 25 degrees. Neither eye could be rotated temporally beyond the midline. Other movements were not restricted.

*Procedure.* On July 14, 1934, a transplantation of the nasal halves of the right superior and inferior recti to the paralytic externus was performed. No shortening operation was done on the externus, and the internus was not touched. On March 27, 1935, a central tenotomy of the left internus was performed in conjunction with an O'Connor cinch operation of the left externus and a transplantation of the nasal two thirds of the left superior and inferior recti.

*Result.* Six months after surgery the right eye was 10 degrees divergent. Each eye could be rotated externally 10 degrees past the midline. A slight left hyperphoria was noted. Convergence was not impaired.

CASE 4. B. H., a 36-year-old white housewife, was seen on August 7, 1935, complaining of cross-eyes following a head injury in an auto accident two years previously. Vision, with glasses, was: R.E. and L.E. 20/20. Under homatropine retinoscopy the following correction was indicated: R.E. +2.00D. sph.  $\approx$  +0.25D. cyl. ax. 90°; L.E. +2.00D. sph.  $\approx$  +0.75D. cyl. ax. 65°.

*Examination* of the eyes was negative

except for position and rotations. Neither eye could be rotated temporally beyond the midline. The patient preferred to fixate with the right eye but alternated on looking laterally. There was some limitation of right infraduction.

*Procedure.* A complete tenotomy with stay suture allowing the left internus to recess 3 mm. was performed on August 30, 1935. On September 10th, an O'Connor cinch operation was done on the left externus together with a transplantation of the nasal two thirds of the superior and inferior recti. On November 1, 1935, a cinch and transplant were performed on the right eye, leaving the internus untouched.

*Result.* Binocular vision was restored in the primary position, and there was 15 degrees of external rotation in each eye. There was a slight right hyperphoria. The patient could read with comfort.

CASE 5. L. S., a 33-year-old white housewife, was seen on December 7, 1933. She complained of double vision of six months' duration. There was no history of trauma nor of intercurrent disease. Vision, uncorrected, was: R.E. 20/20; L.E. 20/15. There was an insignificant refractive error.

*Examination.* The patient held her head toward the right shoulder. The pupil of the left eye was larger than the right. The right eye was deviated 20 degrees nasally in the primary position and could be rotated to within five degrees of the midline. The blood Wassermann reaction was three plus, and a paretic colloidal gold curve was found on serologic examination of the spinal fluid.

*Procedure.* Intensive antiluetic therapy was carried out for 11 months, resulting in definite serologic improvement but no change in the status of the ocular muscles. Some contracture of the right internal rectus was recorded. On October 24, 1934,

a tenotomy with stay sutures was performed on the right internus, allowing it to recess 3 mm. This produced only temporary improvement. On November 21, 1934, an O'Connor cinch operation was done on the right externus together with a transplant of the nasal halves of the superior and inferior recti.

*Result.* The patient complained during the first two months of a horizontal diplopia when she was tired. Internal rotation of the right eye was 35 to 40 degrees and external rotation 25 degrees.

CASE 6. L. C., a 24-year-old Indian woman, was seen on November 18, 1940; her complaint a right esotropia following a head injury resulting from an auto accident two years previously, at which time she was unconscious for three weeks. The patient seemed primarily concerned with the cosmetic appearance. Her vision, uncorrected, was: R.E. 20/70; L.E. 20/15. The right eye could be corrected to 20/20 with a plus 1.5D. sph.

*Examination* revealed no ptosis, but the pupil of the right eye was dilated and fixed to light and accommodation. The right eye was deviated nasally 40 degrees, and practically no external rotation was possible. A suggestive limitation of elevation and depression was noted, but this was difficult to measure in the extreme deviated position.

*Procedure.* Because of the patient's indecision, nothing was done until February 10, 1943, at which time a complete tenotomy with stay suture of the right internus was performed, allowing the muscle to recess 3 mm., followed by an O'Connor cinch operation of the right externus and a transplant of the nasal halves of the superior and inferior recti.

*Result.* Two weeks after surgery the right eye was 10 degrees divergent and it could be rotated 10 degrees externally and 15 degrees internally. The patient re-

turned to the Indian reservation and has not responded to requests for a follow-up.

### CONCLUSIONS

1. Damage to the abducens nerve occurs frequently as the result of head injuries, and leads to varying degrees of paralysis of the external-rectus muscle. An increased incidence of these lesions during the war may be expected.

2. Transplantation operations offer a cosmetic and functional cure for paralyses that do not clear up spontaneously.

3. The degree of function and the degree of contracture of the opposing internus should be checked repeatedly dur-

ing the early periods of the disability, while a spontaneous return of function is awaited.

4. Under ideal conditions, surgery should not be delayed while irreversible changes take place in the internus due to contracture.

5. Neglected cases present a more difficult problem and the prognosis must be more guarded. However, with proper surgical judgment, these eyes can and should be operated on. The results are often gratifying both from the cosmetic and functional standpoints.

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# NOTES, CASES, INSTRUMENTS

## A DOUBLE-BLADED KNIFE FOR SCLERAL INCISIONS IN SHORT- ENING OF THE GLOBE

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The purpose of this knife is threefold:  
it tends to make the resected scleral margins more perfect; it markedly facilitates

the tedious and time-consuming procedure of making the scleral incisions in preparation for inserting the double-armed mattress sutures; and it makes possible a variation in width and type of incisions.

Two number-15 Bard Parker blades from which the slots have been removed and the shanks thinned by filing are mounted into a Castroviejo knife handle of the type used in keratoplasty (see fig. 1). The blades are set to the desired width and the incisions are made into the sclera, first by one long sweeping stroke for marking then by short strokes for cutting until approximately three fourths of the thickness of the sclera is penetrated.

In this manner the making of the parallel incisions with clean-cut edges is insured. The width and type of parallel incisions can be varied with ease. Tapering of the ends can be easily accomplished by pressing the blades together at the beginning and end of the incision.

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## VISION IN ANISOMETROPIA\*

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It is the consensus among refractionists that, apart from strabismus, higher degrees of anisometropia are usually associated with more or less amblyopia in the more ametropic eye, especially when the eyes are hyperopic.

To substantiate this view little is found in the ophthalmic literature. Textbooks give little space to the subject and in the last 25 years there has been only one arti-

\* Read before the Section on Ophthalmology, of the Wisconsin Medical Society, September 14, 1943.

Fig. 1 (McAlester and Borley). Doublebladed knife for scleral resection.

cle in the current literature,<sup>1</sup> in which the writer gives only one case to illustrate his statements regarding the vision in higher degrees of anisometropia. Other writers discuss anisometropia in its relationship to aniseikonia and to prismatic effects in glasses, but these are not statistical reports.<sup>2</sup>

In order to secure data upon which an opinion might be based, 1,000 cases of normal refractions were reviewed. All cases with organic changes in either eye, either congenital or acquired, and all cases with strabismus or a history of strabismus were excluded. It is at once evident that this is an insufficient number of cases upon which absolutely accurate statistics may be based; however, certain facts are evident, and for this reason they are presented.

The spherical equivalents of all cases were determined, and upon this basis they were divided into three groups as follows (anisometropia of less than one diopter is very common and may be omitted, as little visual differences are found):

1. Anisometropia of at least one diopter and less than two diopters' difference.
2. Anisometropia of at least two diopters' and less than three diopters' difference.
3. Anisometropia of three diopters' or more difference.

In group 1 there were 24 subjects (2.4 percent)

- (a) 13 (1.3 percent) were hyperopic
- (b) 8 (0.8 percent) were myopic
- (c) 2 (0.2 percent) had mixed anisometropia, one eye being myopic and the other hyperopic.

In group (a) the following averages were found (without exception the poorer eye refers to the more ametropic eye): average vision of the better eye was 0.9; average vision of the poorer eye was 0.6.

In this group there were seven subjects

who had differences in astigmatism of more than one diopter in which: average vision of the better eye was 1.0-3; average vision of the poorer eye was 0.6-3.

In the five who had less than one diopter of cylindrical difference: average vision of the better eye was 0.9+2; average vision of the poorer eye was 0.6-3.

In analyzing this group closely, so many variations are found that it is evident that the data, while significant, cannot be accepted as the rule because of the exceptions.

This is seen by the following cases: O.D. +4.75D. sph.  $\approx$  +2.00D. cyl. ax. 105°. Vision = 1.0-4; O.S. +3.75D. sph.  $\approx$  +2.00D. cyl. ax. 85°. Vision = 1.0-3. Here spherical anisometropia is associated with no amblyopia.

O.D. +1.00D. sph.  $\approx$  +1.00D. cyl. ax. 60°. Vision = 1.0-4; O.S. +2.50D. sph.  $\approx$  +1.25D. cyl. ax. 180°. Vision = 0.6. Here 1½ diopters of spherical difference resulted in definite amblyopia.

O.D. +0.25D. sph.  $\approx$  +1.00D. cyl. ax. 105°. Vision = 1.2; O.S. +0.50D. sph.  $\approx$  +2.50D. cyl. ax. 75°. Vision = 1.2. Here cylindrical difference resulted in no amblyopia. This is an exception.

From this group only general conclusions can be made; namely, that in moderate anisometropia some amblyopia may be expected in the eye with the greater refraction and that cylindrical differences increase the incidence of amblyopia.

In group (b), the myopic subjects, averages were as follows: average vision of the better eye was 1.0-2; average vision of the poorer eye was 0.8-2.

Four of these subjects had cylindrical differences of less than one diopter in which: average vision of the better eye was 1.0; average vision of the poorer eye was 0.9.

Four had a cylindrical difference of more than one diopter: average vision of



the better eye was 0.9; average vision of the poorer eye was 0.6+3.

It is seen that the average differences are less in the myopic than in the hyperopic, and that in the myopic there is more amblyopia when the cylindrical difference is greater.

In group (c) there were two cases and the vision was normal in all four eyes.

In the second division there were 10 subjects (1 percent) of whom 6 were hyperopic and 4 myopic.

Of the hyperopic: average vision of the better eye was 1.0+1; average vision of the poorer eye was 0.4.

In none of these was the vision the same in each eye, the nearest being: O.D. +2.00D. sph.  $\approx$  +0.25D. cyl. ax. 170°. Vision = 0.6; O.S. +0.25D. cyl. ax. 10°. Vision = 1.2. In this case the astigmatism is the same in each eye.

The greatest difference was: O.D. +0.75D. sph.  $\approx$  +0.25D. cyl. ax. 100°. Vision = 1.2; O.S. +1.50D. sph.  $\approx$  +4.00D. cyl. ax. 110°. Vision = 0.1. In this case there is a great difference in astigmatism.

Basing an opinion on these cases, it is safe to say that in the hyperopic anisometropia of two diopters or more is always accompanied with a definite degree of amblyopia in the eye having the higher correction.

Of the myopic subjects in this division: average vision of the better eye was 0.8+2; average vision of the poorer eye was 0.8-3.

The greatest difference of astigmatism in these was 0.75 diopters, and in this case the vision was the same in each eye.

This is a very small number of cases; however, in them the average vision in the eye with the higher correction was slightly less than that in the fellow eye.

There were 10 subjects in the third division, 5 of them being hyperopic and 5 myopic.

In the hyperopic: average vision of the better eye was 1.0; average vision of the poorer eye was 0.4-1.

In none of these was there a difference of astigmatism of more than one diopter. The average vision of the poorer eye in this group was brought up by one subject: O.D. +4.50D. sph.  $\approx$  +0.75D. cyl. ax. 165°. Vision = 1.0; O.S. +0.50D. sph.  $\approx$  +0.12D. cyl. ax. 60°. Vision = 1.2.

It is significant that in this case glasses had been worn since early childhood. Omitting this case, the average vision of the poorer eye was 0.2.

In the myopic: average vision of the better eye was 0.8-3; average vision of the poorer eye was 0.4-2.

Here there is less difference than in the hyperopic; however, there is amblyopia in all cases in the eye with the greater refraction.

## CONCLUSIONS

From these cases, the following conclusions may be drawn:

1. Anisometropia results in amblyopia in the eye with the greater error of refraction, and this amblyopia is more or less in direct proportion to the difference in refraction in the two eyes.

2. Amblyopia accompanying anisometropia is greater in hyperopic than in myopic eyes.

3. In hyperopic subjects, if the difference in refraction is two diopters or more, it is unusual to find equally good visual acuity in both eyes.

4. In either hyperopic or myopic eyes, if one eye is much more astigmatic than the other, there is greater probability of amblyopia.

The simplest explanation for this condition seems to be that given by McMullen,<sup>1</sup> "The retina of the more ametropic eye has never received such clearly defined images as its fellow." Therefore,

the development of visual acuity does not progress so completely as in the eye with the lesser refractive error.

In high myopia, another factor must be taken into account; namely that retinal changes which accompany this condition may be the cause of the diminished vision and earlier in life these eyes may

have had as good vision as their fellows.

I wish to emphasize the fact that exceptions to all rules were found; however, I believe that this series of cases is large enough to be used as some basis of fact for the opinions generally held by refractionists.

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#### EFFICACY OF VASODILATORS IN FUNDUS DISEASE

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In the last few years a number of enthusiastic reports have appeared in the literature, particularly those of W. F. Duggan and Frederick Cordes, concerning the treatment of various acute fundus diseases by means of vasodilator drugs. In an attempt to evaluate the efficacy of such treatment, 60-odd cases of the following diseases were placed on sodium nitrite—1½ grains injected intravenously—twice a week for one year. These cases were checked twice a week as to visual acuity and from time to time by Dr. Ascher and Dr. Vail as to progression or decrease in ocular pathology. Some results in the acute cases were expected, but few, if any, results in chronic cases. The cases studied comprised early and late luetic optic atrophy; acute chorioretinitis, etiology of which was determined to be tubercular, toxoplasmic, and, in a few cases, focal in origin; acute retrobulbar neuritis; optic neuritis; and alcohol amblyopia. At the end of the year a complete report of the visual acuity, ocular

pathology, and results of treatment was made before the Cincinnati Ophthalmological Society, showing that there was not one case of improvement in the entire list, as regards either increase in visual acuity or decrease in ocular pathology.

These cases were picked at random and no effort was made to separate the acute cases from the chronic. I am therefore rather skeptical of the value of such treatment in ocular pathology.

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#### INCREASING THE ACTION OF A PARETIC INFERIOR-OBLIQUE MUSCLE BY MEANS OF THE O'CONNER CINCH SHORTENING

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Within the past year, excellent articles have appeared in this Journal by James White and Conrad Berens, describing in detail the technique of advancement and resection of this muscle; several years ago John Wheeler advocated a method of tucking or recessing it at its origin. Up to that time, as far as I can learn, sur-

gery of this muscle had been limited to myotomy or myectomy near its origin in order to weaken its action.

It occurred to me that the O'Conner operation, as practiced widely on the Pacific coast, offered the same advantages of safety, flexibility, and ease of performance as for other muscles. I asked Dr. O'Conner if he had ever used it on an inferior oblique, and he replied that he had never heard of its being done, but saw no reason why it should not be. I decided therefore to try it in the following case.

K. W. a boy, aged five years, appeared to have a paresis of all the muscles supplied by the third nerve of the left eye; namely, ptosis, external deviation of the left eye, head rotation, and tilt. Symptoms were recognized at the age of six months. The eye could not be brought to the midline. It could be elevated slightly, in its primary position; not at all, in adduction; and there was a marked upshoot of the right superior rectus when adduction and elevation were attempted.

My first operation consisted of transplanting the two nasal halves of the superior and inferior recti muscles into the stump of the internus, which was well resected, and the externus was resected. This abolished the head rotation and gave the patient a negative cover test, made the eyes appear straight in the primary position and allowed an adduction of 15 prism degrees.

There still was no elevation, in adduction. After two months the inferior oblique was exposed at its insertion, as described by White and Berens, the tendon was split into three, and eight strands of medium dermal were used as the cable, which was carried downward past the temporal limbus and buried under the conjunctiva, emerging in the lower fornix.

The patient was seen by Dr. O'Conner

and another colleague, who agreed that the shortening had resulted in the restoration of about 50 percent of the normal function of the muscle.

This report is made to offer a variation in surgical procedure. The same advantages are found, when applied to this muscle, as obtain when it is used for other muscles.

490 Post Street.

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### NERVE BRANCH AT SUPERIOR ORBITAL FISSURE CONNECTING SIXTH CRANIAL WITH COMPONENT OF SPHENOPALATINE GANGLION

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New York 29

As the sixth cranial nerve enters the orbital area, a branch descends from it to join either the nerve of the pterygoid canal or the margin of Meckel's ganglion. This communicating (association) nerve at times is quite strong, at times is frail. The size (in same head) varies greatly on right and left sides, occasionally is large on both sides. At times, I have failed to expose it on one or both sides.

The branch is mentioned in a footnote by Holden (Manual, ed. 4, London, 1897, p. 220). It is so frequently found in my dissections, as to render a note advisable. The sixth cranial nerve communicates with the ophthalmic nerve (its lacrimal part?) while within the cavernous sinus. Such arrangement favors a path from the ninth cranial and the seventh, in the question of the parasympathetic supply of the lacrimal gland.

We are told, also, that the lacrimal nerve may be absent (Piersol, p. 1234) and the fourth cranial nerve may send a supply to the lacrimal nerve. The trochlear (fourth) nerve is a variable nerve, among others, and communicates with the frontal

nerve at apex of the orbit (Piersol, pp. 1230, 1234). It is interesting in relation to the rare (human) lacrimal glandular tissue at the medial area of the orbit (Harderian?). Evidently to the Harderian gland a parasympathetic and a sympathetic nerve supply is present. Man (and the whale) default as to the usual occurrence of this medial gland. But the fourth cranial nerve communicates occasionally with the frontal, supratrochlear, infra-trochlear, nasociliary, and lacrimal.

The otic ganglion appears to be in the

course of the parasympathetics to the parotid. The otic ganglion communicates with the vidian nerve (nerve of pterygoid canal) and thence to the sixth nerve and to the lacrimal nerve via the branch here noted.

Since the lacrimal gland resembles the general structure of the salivary gland, it would be expected to have some connection with the otic ganglion. Apparently the sixth cranial nerve affords an association link.

*20 East One-hundred-sixth Street.*

## SOCIETY PROCEEDINGS

EDITED BY DR. DONALD J. LYLE

### NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

January 4, 1943

DR. ISADORE GIVNER, *presiding*

#### CYLINDER RETINOSCOPY

DR. JOSEPH PASCAL discussed this subject during the instructional hour.

#### ANISEIKONIA

DR. ARTHUR LINKSZ commented on this subject and presented a moving picture.

#### INFLUENCE OF COLOR ON MUSCLE TONUS

DR. ERNEST METZGER said he would discuss phenomena identical with the phototropism and phototaxis of lower animals and plants. Light sensitive, motile, unicellular organisms having half the body surface exposed to light may show contraction in one direction or expansion in the other. Positive or negative phototropism depends on the intensity of the light stimulus. The photochemical effect of various monochromatic lights differ, and plants and animals react differently

in red, green, or violet light. There is no basic difference between the light reactions of man and those of the most primitive unicellular organisms.

In animals with specialized light-perceiving organs and a symmetrical arrangement of the nervous system and organs of motion, stimulation or exclusion of half the light-perceiving area is followed by unilateral increase of muscle tonus producing changes in posture or the direction of motion similar to those following vestibular stimulation. This explains the compulsory flight of insects to light.

A diagram was presented showing the optic pathway from the visual field to the calcarine region of the opposite side, thence to the motor cortex from which the pyramidal tract descends to the contralateral muscles of the neck, trunk, and antagonistic muscles of the extremities. Equilibrium is maintained by the vestibular apparatus, which produces changes in the tonicity of antagonistically acting muscle groups. Proprioceptive stimuli produce similar effects. Acous-

tic and thermal stimulation may produce tonic reactions toward the side of the stimulus.

Dr. Metzger alternately illuminated the eyes in rabbits and found a tonic turning of the neck and vertebral column and a shifting of the weight toward the light. In man, as in other higher animals, tonus changes resulting from visual stimulation are inconspicuous and overshadowed by the other equilibrium-regulating mechanisms. Relatively slight disturbances in the tonus of antagonistic muscle groups, however, become evident in the Romberg position; that is, toes and heels together and eyes closed. With so-called tonus spectacles, which transferred illumination from one eye to the other, or from one-half the field to the other half in the same eye, there was an increase of muscle tonus on the same side of the body as the illuminated eye or visual field.

The previous experiments were performed with mixed white light. With a red filter before one eye and a green one before the other, an increase in muscle tonus was seen on the side of the green field, manifested by a tendency to sway to that side, although most subjects could not state which was the green side. With the open eyes gazing at the junction of the colors of a half-red and half-green field a similar result was obtained, but the steadying influence of fixation made it less convincing; the contrasting after-image, however, produced a very strong tonus reaction toward the original red side. With the arms held forward, on exposure of both closed eyes to red, there was a divergence of the arms and a tendency to sway backward; green produced the opposite effect.

These examples illustrate that retinal processes, independent of vision, influence tonus equilibrium. A similar independence is shown by the tonus-increas-

ing effect of a green light on the pupil, as contrasted with the tonus-decreasing effect of a red light of the same intensity.

Chromatic aberration in the eye results in a 2- to 3-diopter difference between the foci for red and blue. Focusing is faster and more efficient in mixed than in monochromatic light.

Finally there is a time difference in the perception of moving objects in different spectral colors. A rotating white drum with vertical black stripes in a white light seems to have a red streak before and a blue streak behind each stripe.

Clinically, these phenomena are of possible value in the diagnosis of cerebral disturbances without paresis of peripheral muscles. This may also be the basis for a new approach to the problem of synesthesias, and it is hoped to show later that the coldness of blue and green, the warmth of red and orange, and the relationships of certain sounds and colors are not psychologic, but are due to correspondence of the tonus reactions. On this conception, chromatic aberration of the eye appears significantly linked to equilibrium.

*Discussion.* Dr. Ignatius Sommers said the traditional teaching is that the eye, labyrinth, and sensibility (superficial and deep), maintain equilibrium and that fixation is necessary. We now recognize that light alone can influence tonus equilibrium and, clinically, unequal illumination of the closed eyes can cause normal light-tonus reactions misinterpreted as pathologic. Light-tonus reactions may inhibit or augment tonus reactions produced at any sensory sphere. Diagnostic errors may thus occur on the examination of the relation of other sense organs to the tonus equilibrium. For instance, a patient with a complete loss of his labyrinths may show a falling tendency on vestibular examination if his retinas are stimulated

unequally. Such unequal retinal illumination, if overlooked, may produce false findings, on pointing, gait, and arm-tonus reactions and on testing for ataxia. The influence of light on eye-muscle tonus is important ophthalmologically; optokinetic nystagmus depends on light, and color and spontaneous nystagmus may be influenced by light and labyrinthian tonus simultaneously.

We can assume stimuli from the retinas and labyrinths as being constantly present and influencing the tonus of the body's musculature. Light tonus becomes as important for maintaining equilibrium as the various postural and righting reflexes. Although the paths of the latter are mostly subcortical, the former is cortical, from the optosensoric to the motor cortex without reaching consciousness.

It is to be hoped that Dr. Metzger will continue his promising experiments with still finer methods and especially with pure spectral colors.

Dr. Alfred Kestenbaum pointed out that the experiments were with red and green and wondered whether the reactions would be greater with red and violet, which lie at the two ends of the spectrum. In other words, do the reactions depend on the difference in wave lengths of colors or on complementary colors?

Dr. Joseph Mandelbaum suggested the differences found for red and green were artifacts, as the tests were performed with the eyes closed and the lids acted as red filters, which would cause the red side to be brighter than the green. Therefore the tonus reactions need not be related to colors. He also said that pupillary reflexes do not differ for different colors if their brightness is equal.

Dr. Benjamin Friedman also said the lids would hold back the green light. He also said the apparent lagging of the stripes of the half of the rotating drum in the red light behind the stripes of the half in the blue light could not be interpreted

as unequal muscular reactions in the eye. The eye does not move faster for one part of the drum than for another; it moves *in toto*.

Dr. Joseph Pascal showed that in addition to the possible role of chromatic aberration in accommodation another factor may be at work. The usual method of showing diverging and converging pencils of rays obscures the fact of the wave front of light. When the eye is focused for some point the light waves from a nearer object strike the retina as concave waves (concave to the retina) whereas the light waves from a farther object strike the retina as convex waves (convex to the retina). There is probably some mechanism which causes a different reaction to this difference in wave front. The concave wave fronts call for more accommodation and convex wave fronts call for less accommodation.

Dr. Metzger, in closing, said that he had been forced to perform his experiments with the complementary red and green as they were the only colors of the same brightness he could obtain. Even though the lids held back part of the green light, the tonus reactions could not be due to the differences in light intensity, as the reaction on the green side is the same as if it were the more intensely illuminated. He said that Hess showed that the pupil is larger if illuminated with red than with blue light of the same intensity. In the case of the rotating drum, blue is perceived earlier than red and the stripes seem farther forward.

#### OBJECTIVES OF ORTHOPTIC EXAMINATION AND TRAINING

DR. ARTHUR LINKSZ said that one has to consider a patient's social, familial, and psychologic background before deciding whether orthoptic training is feasible at all. In squint, orthoptics is part of the plan of rehabilitation; it does not supplant operative treatment. It is basically a teach-

ing procedure, applied to individuals with faulty sensorimotor visual habits.

The first task of an orthoptic examination is to determine a patient's mode of fixation. The next is the analysis of his binocular visual habits. This includes the determination of whether or not he is able to fuse, and how much his adaptive ability is to retain or restore fusion ("amplitudes").

One of the most conspicuous binocular visual habits in squint is suppression. This occurs normally, too, at any time when contours of opposite gradients and unequal impressiveness are presented to corresponding areas of the two retinas (Werner effect). Two suppression scotomas have to be differentiated in the binocular field, one of the macula of the squinting eye, the other of the secondary macula of this eye (that is, of that retinal area which receives the same pattern as the fovea of the fixating eye). Anomalous sensory correspondence is the habit of selecting these two areas in unitary acts of attention and fixation. Amblyopia develops as a habit when the more impressive contours always belong to the same eye.

Orthoptic training is indicated for patients who maintain binocular balance with difficulty—for example, convergence insufficiency—or who develop faulty and inferior binocular visual habits—for example, anomalous sensory correspondence. Methods to be applied depend on the patient's age, intelligence, background, and compliance with other procedures indicated in the individual case.

*Discussion.* Dr. Joseph Pascal said the red-glass test might be used to measure the seriousness of an imbalance. If an imbalance is found by the red-glass test, then the error may be considered as likely to cause distress. If no imbalance is found with the red-glass test but one is found with the Maddox rod, the imbalance may be considered as being within the patient's comfortable fusion range. He asked

whether Dr. Linksz considers fusion a unification or replacement of images, mentioning Dr. Verhoeff's views. He also brought up the question of retinal massage and the great divergence of views as to its effectiveness in overcoming anomalous retinal correspondence, as seen on the one hand in some of the glowing reports in the literature and on the other in the recent one by Dr. Fowler of Chicago.

Dr. Linksz, in closing, said that all theories of fusion are only theories and whatever seems most satisfactory is the best. Statistics of the efficacy of orthoptic training are not particularly valuable, and a single case in which he has broken down anomalous correspondence and has developed fusion and good binocular habits is more significant than a whole series of failures.

#### PRESENT-DAY STATUS OF CORNEAL SURGERY

DR. RAMÓN CASTROVIEJO said corneal ulcers may be treated by performing a delimiting keratotomy to increase tissue resistance. If cauterization is required, fulguration is better controlled than are chemicals.

Corneal tattooing with India ink has been superseded by gold or platinum chloride. These are applied after denudation of the epithelium and superficial stroma and then neutralized with 1-percent tannic acid. Corneal transplants must be of larger than usual dimensions where large scars are present so that they may be in contact with healthy cornea.

Corneal grafts have been performed in cases of dystrophies, with good results. However, in dystrophia adiposa, the outcome is unfavorable but may be improved by first performing a superficial keratectomy and then prescribing a proper diet. In the absence of recurrence a transplantation may then be done.

Round grafts are satisfactory, are less



flexible than square ones, which also have cleaner incisions.

Corneal transplantation is not a difficult procedure to master for the usual cases. In keratoconus it is difficult to perform because the tissue is too thin to support the graft; the latter rather supports the cornea in which it is placed.

When the cornea is vascularized, a superficial keratectomy must be performed. This may be followed by keratoplasty but may in itself provide useful vision.

Slides illustrating the paper were presented. Also shown were a motion picture of keratoplasty for keratoconus and one of the correction of a vascularized cornea with symblepharon.

*Discussion.* Dr. R. Townley Paton said that keratoplasty is less difficult than it first appears. He has tried to simplify it by using standard-sized instruments whenever possible; for example, ordinary Stevens scissors, ground to a fine point, serve adequately in cutting a square window, and a curved pair when making a round window. He prefers the round grafts for the cosmetic result.

Dr. Paton does not agree in regard to using a single suture for holding the graft in place. Many times there is a slight overriding of one edge of the graft, and unequal pressure is desired in tying the suture. He, therefore, employs two sutures, crossing them in the middle. The importance of placing the sutures close to the edges of the incision in the cornea cannot be overemphasized.

In a successful take of a graft, the anterior chamber is usually re-formed within four days. In one case in which there was a draining fistula formed by incarceration of the iris, the anterior chamber repeatedly collapsed over a period of four months. After the incarcerated iris was freed, the anterior chamber re-formed permanently, and

the graft retained partial transparency.

The ideal case for corneal graft is one in which there is a central opacity and an absence of blood vessels. In old degenerative corneal conditions, keratoplasty may be indicated, and in one such case three keratoplasties were performed, two in one eye. The patient is now able to walk about unassisted for the first time in his life. He has been under observation for a period of two years.

Though many of Dr. Paton's cases have not retained transparency of the cornea, not one was a failure in the sense that the patient was made worse by the attempt. Keratoplasty in colored people does not give as encouraging results as in whites. This has been reported in other types of eye operations in the colored races.

Dr. Olga Sitchevska discussed Filatov's work. He often used conserved cornea, kept at 2° to 5°C. for not less than two and up to six or seven days. Cadaver cornea seems to institute a reaction which aids the healing process. Filatov has performed over 1,000 transplants, for therapeutic as well as optical purposes. They have been done in cases of trachomatous pannus and tubercular, luetic, rosacea, and sclerosing keratitis with good results and greatly accelerated subsidence of the inflammation.

Dr. Castroviejo, in conclusion, said the cosmetic result is satisfactory with a square implant that is not transparent. The use of cadaver cornea is not new and much research shows it is not better than fresh cornea, but rather the reverse is true. If a graft becomes opaque it must be removed entirely when another keratoplasty is performed. He has not dared to operate on inflamed eyes and finds that the use of a spatula as a guard can do damage. In favorable eyes he obtains 80 to 85 percent transparent takes.

Leon H. Ehrlich,  
Secretary.

# COLORADO OPHTHALMOLOGICAL SOCIETY

January 16, 1943

DR. JAMES M. SHIELDS, *president*

## PIGMENT SPOT (NEVUS) ON CORNEA

DR. WILLIAM H. CRISP presented a 12-year-old boy who had been brought in because of a supposed foreign body on the cornea near the upper limbus. The wind had blown something into the boy's eye, and, although he had experienced no difficulty after the first 24 hours, the mother had watched him for possible presence of the foreign body and had discovered the corneal spot. There was no foreign body and no loss of corneal tissue; however, just within the limbus there was a dark brown spot, level with the surrounding epithelium and having an irregular extension downward in the vertical meridian. The irregularly circular main portion of the spot had a diameter of about 0.33 mm. The eye was free from irritation.

Under the slitlamp the spot appeared to be made up of fine pigment granules, closely approximated to one another, and lying just beneath the corneal epithelium. The upper border of the pigmented area was almost reached by a fine arterial branch which terminated in a slight apparent expansion of the vessel, and from this expansion a fine venous branch could be seen receding upward but fading away into the deeper scleral tissue. The eye was normal in every other respect and the uncorrected vision was 20/16. The parents had been advised to have the condition watched from time to time to see if any change occurred in the size of the pigmented area.

*Discussion.* Captain George F. Gsell asked what should be done if the nevus started to increase in size.

Dr. Crisp, in answer to this query, suggested taking a specimen for labora-

tory examination, cauterization, and then making a conjunctival flap.

## CONGENITAL CATARACT

DR. W. M. BANE presented two cases of congenital cataract. The first patient, H. S., aged four years, was one of five children, three of whom have either congenital or developmental opacities of the lenses. This patient was seen about one year ago by an eye doctor who reported that the opacity in each lens resembled the developmental form of infantile nuclear cataract, and the boy seemed to have fair vision. During the past year the parents have noticed that the vision was worse, and that the cataracts were visible to the naked eye. The lenses were completely opaque. The case was unusual in that seldom are any changes seen in these nuclear cataracts, but in this one, progression to maturity had been quite rapid. An older sister was operated on for a very similar bilateral cataract.

The second patient was E. S., a two-year-old brother of the first patient. The lens in each eye showed opacities located on the posterior surface which were thin, flat, and irregularly shaped. They represented unusually extensive persistence of the tunica vasculosa lentis. This type of opacity is rather uncommon. No remnant of a persistent hyaloid membrane was observed. In Duke-Elder's textbook it is stated that these plaques consist histologically of dense connective tissue, with oval and spindle-shaped nuclei, and are not pigmented. Since the vision was only slightly impaired no interference was contemplated.

*Discussion.* Dr. Fritz Nelson suggested surgery—making a keratome incision of the cornea and also penetrating the lens, immediately expressing it.

## UNUSUAL PIGMENTATION OF THE FUNDI

DR. HARRY SHANKEL presented the case of G. E. M., aged 40 years, who was

first seen in December, 1937. He had had frequent headaches after close work for the past four months. The headaches were occasionally accompanied by blurring of the vision. The patient had never worn glasses.

The vision, R.E., was 20/20; L.E., 20/40+. The tension was normal to palpation. The pupils reacted to light and accommodation. The ophthalmoscopic examination of the right eye revealed no pathology. The left eye showed increased pigmentation in the lower nasal quadrant and a peculiar pigmentation about the vessels.

The refraction was R.E. +0.50D. sph.  $\Rightarrow$  +0.12D. cyl. ax. 80°, vision 20/15; L.E. -0.25D. sph.  $\Rightarrow$  +0.25D. cyl. ax. 90°, vision 20/15. The patient returned on December 22, 1942, with the complaint that his eyes burned and hurt. Results of the external examination were negative. The refraction was practically the same as found five years previously. Ophthalmoscopic examination of both eyes revealed a peripheral pigmentation, particularly about the blood vessels. The visual fields showed some contraction. The general physical examination was negative except for blood pressure of 130/99. The blood Wassermann test was negative. There was no history of night blindness.

#### TUBERCULOUS CHOROIDITIS

DR. W. T. BRINTON presented the case of Z. P. B., aged 47 years, who stated that he had had an injury to his right hip in 1918. A positive diagnosis of tuberculosis of the right sacroiliac joint was made in 1924, and he had been under care for this condition ever since.

In 1933 the right eye was inflamed for one month, but there was no apparent visual disturbance. He was advised in June, 1938, while taking a driver's test, that the vision in the right eye was poor, the left normal.

In September, 1941, he noticed that the vision in the left eye was failing but obtained glasses which helped the vision. During this year he lost central vision in the right eye, following an abscess of the hip. One month ago the vision in the left eye began to fail. His glasses were changed but without improvement. Examination of the fundus showed choroidal patches in both eyes, more marked in the right. The macular region in each eye was involved. The choroidal patches presented all stages from grayish yellow areas to dark pigmented spots. A diagnosis of tuberculous choroiditis was made.

#### KERATOCONJUNCTIVITIS

DR. FRITZ NELSON presented the case of J. J., a 26-year-old man who worked at an airplane factory as stock-room clerk. His right eye became inflamed in November, 1942. General physical examination revealed no pathology. The blood Wassermann test was negative. X-ray studies of the teeth showed nothing abnormal. The condition cleared up somewhat but only for a short time. He was seen for the first time on December 22, 1942. Examination revealed a superficial punctate keratitis, right eye, with marked injection of the entire eyeball. The iris was normal. Herpes labialis was present. There were epithelial foci located in the temporal section of the cornea. Two days later all foci were practically healed. The patient started back to work on December 26th. The eye remained quiet until December 31st, when the same condition recurred. He was given 1/10 S.E.D. X ray, unfiltered. The condition was completely healed on January 4th. In five days he suffered a recurrence, and again only in the right eye. The left eye was never affected. Smears revealed no bacteria.

The question arose whether the condition was an epidemic superficial keratoconjunctivitis (virus disease) or caused

by some chemical agents at his place of employment. Similar cases seemed to occur more frequently in Colorado during the past six months, with very frequent recurrences. Local treatment very often proved ineffective.

*Discussion.* Dr. R. W. Danielson asked if it might not have been similar to the condition reported in epidemic form on the coast, and, if it was, suggested the use of riboflavin.

Dr. D. H. O'Rourke said that it did not make much difference what type of medication was used, as the condition had a tendency to recur and that X-ray treatment was not advisable. He suggested the use of vitamins and 5-percent sulfathiazole ointment, or that half-strength iodine applied to the denuded surface was possibly the treatment of choice.

#### LEUCOMA OF EYE FOLLOWING INJURY

DR. JOSEPH TSCHETTER presented the case of A. B., aged 52 years, who said that about one year ago he was chopping wood and a small piece hit him in the left eye. He went to a local doctor, and the piece of wood was removed. Three days later, when the eye became painful, he appeared at the Colorado General Hospital and was hospitalized.

Examination revealed a large, gray, central opacity with deep congestion and a very painful eye. The tension was normal. The pupil was adherent posteriorly and there was exudate in the anterior chamber. Vision, R.E., was 20/200, without correction; L.E. perception of hand movements. Results of the external examination of the right eye were negative. The tear ducts were in good condition.

Treatment consisted of the application of hot, moist compresses; 5-percent sulfathiazole ointment; 1 mg. riboflavin, three times a day; 1-percent atropine, locally; intravenous injections of typhoid; and multiple paracenteses. A delimiting kera-

totomy was performed with daily opening.

The refractive error, R.E., was  $-2.50D.$  sph.  $\approx -0.50D.$  cyl. ax.  $85^\circ$ , vision 20/20. A  $+2.00D.$  sph. was added for reading. The left eye could not be improved with lenses.

The patient left the Hospital at the end of one month. He returned to the Out-Patient Department at the end of six months, at which time examination revealed a large leucoma with straight margin and synechia. The lens could not be seen. An optical iridectomy was advised and performed. The lens was found to be cataractous; it was extracted at a second operation.

Walter A. Ohmart,  
Secretary.

#### CHICAGO OPHTHALMOLOGICAL SOCIETY

January 18, 1943

DR. LOUIS G. HOFFMAN, *president*

#### SCIENTIFIC PROGRAM

THE TREATMENT OF LESIONS OF THE EYE  
WITH BETA RADIATION

DR. A. D. RUEDEMANN (by invitation)  
presented a paper on this subject.

#### CLINICAL PROGRAM

(Presented by the Department of Ophthalmology, Loyola University)

CLOSURE OF CENTRAL RETINAL ARTERY,  
RIGHT EYE

DR. PAUL CARELLI presented a 19-year-old white boy who was first seen on October 25, 1941. The vision of the right eye had suddenly become blurred a few hours earlier. There was no history of trauma. General physical examination and past history were essentially negative.

Vision, R.E. 1/200, L.E. 1.2-2 and

J1. External examination was negative. The fundus of the right eye showed pallor of the temporal portion of the disc margin extending to the macular region, about which there was intense pallor with a cherry-red spot.

He was admitted to the hospital where therapy consisted of vigorous massage of the eyeball and paracentesis of the anterior chamber. Acetylcholine, one gram, was given daily. Pilocarpine sweats and vasodilating drugs by mouth were administered. After 15 days' hospitalization he was seen daily at the office, and was given nine injections of nitroscleran, 1 c.c. intravenously.

At this time vision in the right eye was sufficient only to count fingers at 2 feet.

#### CLOSURE OF CENTRAL RETINAL ARTERY, LEFT EYE

DR. PAUL CARELLI said that this man, aged 27 years, gave a history of sudden loss of vision on June 17, 1942. He went to a clinic where he received an injection into his arm. Three days later he reported for examination.

Vision, R.E. 1.2-1 and J1, L.E. nil. The left eye was externally negative. The pupil was slightly dilated and reacted sluggishly to light. Fundus examination showed that the disc margins were blurred, the blurring extending from the temporal region outward slightly beyond the macular area. The entire macular region was pale, with a small red spot in the center. The remainder of the fundus was apparently normal.

All laboratory and physical findings were negative. The patient received bi-weekly injections of 1 c.c. nitroscleran and 1 c.c. thiamine, eight injections in all, with large doses of vitamin-B complex. About four months after onset there developed secondary atrophic changes of the disc of the left eye with dark-brown

pigmented areas about the macula. There was no improvement in vision.

Robert Von der Heydt.

### SAINT LOUIS OPHTHALMIC SOCIETY

January 22, 1943

DR. CARL BEISBARTH, *president*

#### CATARACT EXTRACTION WITH THE USE OF NEW SUCTION APPARATUS

DR. WILLIAM E. SHAHAN described his clinical experiences in cataract extractions, substituting metal mask and colodion dressings for the ring mask. He discussed the need of taking cultures pre-operatively and the value of a definite time interval after the use of cocaine and adrenalin for local anesthesia. He exhibited an apparatus which he had used experimentally for the extraction of lenses through hypodermic needles connected with a vacuum and a rotating drill.

*Discussion.* Dr. F. O. Schwartz described an experience he had had with atropine and cocaine in oil. Following a cataract operation Dr. Schwartz had had the atropine and cocaine in oil delivered to the patient's bedside. Four hours later the patient was found sitting up in bed, completely out of his mind. He had received the full bottle of atropine and cocaine representing 1 gr. of atropine and 2 gr. of cocaine. Hyperemesis and catharsis were induced. Enemas were given and 20 hours later the patient was completely normal.

Dr. B. Y. Alvis asked why the patient would be unable to close his lids after cocaine and adrenalin had been injected subconjunctivally, and also, if Dr. Shahan paid any attention to what type of growth was found in the cultures. He said that Dr. Julianelle, after examining the cultures, had reported on whether they were *Staphylococcus albus* or *aureus*, and if

they were mannite fermenting or not. Some other organisms were identified but the main attention was paid to those known as *Staphylococcus aureus*. No organisms were considered by him to be innocuous but that many a patient having a mild culture of *Staphylococcus aureus* had been operated on, apparently without results.

Dr. M. Hayward Post said that it would be well, before following this practice, to consider the toxicity of cocaine. He believed that the exact strength of the solution used should be known and the amount given accurately determined. It is well recognized that as people grow older their tolerance to cocaine becomes greater. Conversely, in young people it might be dangerous to inject this drug four times, unless the amount of each injection were small, because of the absorption of cocaine into the system.

Dr. Shahan, in closing, answered that the injection is made as far as is possible into the cul-de-sac and that there must be some permeation into the orbicularis fibers. With regard to the cultures Dr. Shahan replied that he did not care what organism was found. If any growth at all was found he would be concerned.

Dr. Shahan said that he used this solution quite freely in people of all ages, even in children. He thought that the toxicity of the cocaine was controlled by the use of adrenalin with it. He used a solution of 5-percent cocaine in adrenalin 1:4,000. The adrenalin prevents the rapid diffusion of the cocaine into the system. Except for an occasional temporary collapse he had never had any bad effects from its use.

#### PENTOTHAL SODIUM ANESTHESIA IN OPHTHALMOLOGY

DR. LAWRENCE T. POST and DR. E. NORRIS ROBERTSON presented a paper on this subject which was published in this Journal (November, 1943).

*Discussion.* Dr. T. E. Sanders said that

he had been on the ward service with Dr. Robertson in October, 1942, when the use of pentothal sodium on ward patients had been started. He stressed the value of using some local anesthesia with the pentothal sodium in many types of patients.

Dr. L. T. Post said that pentothal sodium anesthesia had been highly recommended to him at the Academy meeting last fall. His experiences with his private patients were limited, but the reaction of those who had received the drug was very favorable. This included some patients who had had previous operations under other anesthesia. The only change made in the procedure was to put in a stay suture through the superior-rectus tendon to keep the eye under control during the operation. In 344 patients at Barnes Hospital there have been no deaths from the anesthetic. One would think it as safe as any general anesthetic could be if good judgment were used in employing the drugs. The question of vomiting concerns us considerably. The incidence was too high to make one want to risk every case of cataract with it. The preliminary drugs used and the postoperative diet given might be of considerable importance in causing vomiting. Only one of the several patients on whom he had operated vomited and she had received hyoscine. In general, he thought that pentothal-sodium anesthesia was a godsend for the high-strung nervous patient.

Dr. B. Y. Alvis said that he may have been the first here to have used the intravenous anesthesia. Over two years ago he had used it and it had worked out very satisfactorily in a cataract case in which there was considerable prolapse of the iris. His experience was so favorable with that case that he has used this form of anesthesia intermittently in the Jewish Hospital since that time. In his small series of cases none of the patients had vomited except those who had had preoperative narcotics. He felt that this was

responsible for the vomiting in most cases. By using local anesthesia in addition to the pentothal sodium one can help prevent the patient's moving suddenly. He has had several patients who sneezed violently during the induction. He believes that this has now been controlled by using a slower induction. He reported one patient who had had his first eye operated on for cataract under pentothal sodium and had been very disappointed when the second eye had been operated on under local anesthesia alone.

Dr. William H. Meinberg said that it had been used for several months on eye patients at Homer Phillips Hospital (for Negroes). He had had some trouble on account of vomiting and because the patient came out from the anesthetic during the operation. This was especially so in young robust patients.

Dr. M. Hayward Post inquired about the use of pentothal sodium at various ages, and asked if it was safe to combine it with other general anesthetics.

Dr. F. O. Schwartz described an enucleation in which pentothal sodium anesthesia had been used with very favorable results.

Dr. Robertson, in closing, said that on the advice of the anesthetists pentothal sodium had not been given to children. In general, pentothal sodium can be combined with other general anesthetics. Young healthy patients seem to react more satisfactorily than those who were not so robust, although in this series there had been no one under 20 years of age.

#### RETAINED INTRAOCULAR FOREIGN BODY

DR. L. V. GORILLA described a patient whose eye had been penetrated by a foreign body while he was chiseling on a door. When he was examined, one week later, a small dark foreign body was observed near the back of the eye about two disc diameters temporal to the macula. The foreign body could be seen to move

when a magnet was applied in the neighborhood of the eye. The course of the foreign body through the cornea, the iris, and the vitreous could be traced. Operation was refused. Normal vision was retained for eight months. Then a mild choroidal and retinal reaction developed which reduced visual acuity to 20/25. This has persisted to the present time or for more than a year without further reaction or loss in vision.

*Discussion.* Dr. Adolph Lange said that the lack of reaction to the foreign body was particularly striking and perhaps unfortunate; that although the eye had been perfectly clear for so long the retinal and choroidal reaction might continue and eventually cause loss of vision.

Dr. William E. Shahan described several cases of intraocular foreign body which had come under his observation—in one case penetration by a piece of copper. Four years later the eye became discolored and inflamed, and had to be removed.

Dr. John Green described a case in which a patient's only eye contained a piece of copper in the vitreous. An inflammation of the eye that developed three years after the injury quieted down eventually following the administration of large doses of potassium iodide. Glaucoma developed later but was controlled by operation and miotics, and the eye has continued to retain some vision.

Dr. William M. James described a case in which an eye had retained a sliver of glass in the iris for three or four years without any loss in vision or sign of irritation.

Dr. H. R. Hildreth said that one of his patients had had a tiny piece of glass in the iris of one eye. This eye remained chronically inflamed until the piece of glass was removed. It then became quiet and has remained so for about three years.

James Bryan,  
*Editor.*



# AMERICAN JOURNAL OF OPHTHALMOLOGY

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## ADEQUATE MEDICAL CARE

Some may feel that the columns of a journal devoted to a medical specialty are hardly the place to discuss proposals for socialized medicine. But the practitioners of a specialty are surely not less concerned in such proposals than the general physician.

The successful specialist may be disposed to think that his private practice will not be affected by socialization to the same extent as that of the general practitioner. This, however, is hardly true.

The practice of ophthalmology is con-

ducted not merely in the private office of the ophthalmic surgeon, but in the public clinic, in the "charity" or community hospital, and last, but not least, in the store or office of the optician or optometrist. The social and economic interrelationships of all these fields of activity are matters of concern to every ophthalmologist.

It can hardly be said that free discussion of proposals for socialized extension of medical care has been encouraged in national medical periodicals. In private gatherings of physicians we hear various opinions, although we may be conscious

at times of a sort of fear, on the part of the less outspoken and less independent thinkers, that they will lose caste among their professional brethren if they venture to express themselves in conflict with the general current of opinion. On the other hand, there is perhaps a disposition to authoritative overassertion on the part of those who condemn utterly, instead of discussing patiently, legislative proposals for national or state medical care.

In spite of the conclusions of the Committee on the Costs of Medical Care, 1932; the findings of the two-volume study entitled "American medicine: Expert testimony out of court," 1937; the report of the California Medical Economic Survey, 1938; and the report of the National Health Conference, 1938; as well as recent startling data concerning the health and medical care of draftees, we encounter sweeping statements as to the approximate perfection of our present system of medical care and its alleged superiority to anything which the world has yet produced or to anything that might develop out of a controlled national system.

Butler (Department of Pediatrics, Harvard Medical School), in an article published by "State Government," organ of the Council of State Governments, March, 1944, makes the general accusation that the societies representing organized medicine fail to permit expression of a minority opinion. This is in part due to the peculiar practice of considering a majority opinion as the unanimous opinion. (Incidentally, the writer of the present comment has always regarded as unwholesome and misleading the tendency of organizations to resolve that the majority opinion is the unanimous opinion.)

Garceau, in his book entitled "The political life of the American Medical As-

sociation," explains how this result is accomplished without open violation of democratic principles. Butler declares that, in consequence of this restriction of minority opinion, and the incidental inhibition of deliberate discussion and progressive thought, "organized medicine is notoriously reactionary."

This disconcerting conclusion is supported by citation of a series of incidents in the recent history of organized medicine in this country. Although Blue Cross hospital insurance is now referred to as indicating the readiness of the medical profession to support measures which will render national health insurance unnecessary, we are reminded that as late as 1934 the American Medical Association opposed this form of voluntary insurance.

In that same year, a plan by the American College of Surgeons for prepayment of medical care at approved hospitals was condemned by the Judicial Council of the American Medical Association.

In 1934, two California physicians who operated a group prepayment medical service were expelled from the Los Angeles County Medical Association and from the medical association of their state. The Judicial Council of the American Medical Association subsequently reported that these two physicians had not had a fair trial.

In 1938, the Journal of the American Medical Association, in discussing California's medical problems, mentioned that "continuous efforts to induce county medical societies to organize prepayment medical service groups" had so far been "successfully discouraged."

In any informal gathering of physicians, it is common experience to hear trade unions condemned for their extreme practices, including suppression of minority opinion. Yet a tendency toward

a sort of trade-union autocracy, with suppression of individual opinion in matters of professional ethics and economics, is rather common among medical organizations. An example of this attitude was the attempt made a few years ago, by the council of one of the largest state medical societies, to provide that "component county medical societies, their officers, committee-men, and members shall not initiate any policy, propose any legislation, or participate in any activities that are contrary to the policies of the Medical Society of the State. . . ."

The proposal was defeated, but we wonder what the Supreme Court of the United States might have said, if this proposal had been adopted, as to its bearing upon the "accepted laws of free enterprise." (See the Court's decision in regard to the A.M.A. and the Group Health Association of Washington, D.C.)

Butler raises the question whether organized medicine is more interested "in perpetuating a time-honored system of medical practice than in providing better and more economical medical care."

Within the profession there is certainly an important body of minority opinion which does not regard the present system, or lack of system, as providing the most perfect possible form of medical care. The section of the community which is least adequately covered by the present situation, even with the aid of the voluntary prepayment schemes, is the so-called "intermediate low-income group." Moreover, there are certain objections, on the score of efficiency and economy, to insurance systems in which individual fees-for-service are established by the physician in his direct relationship with the patient. There is considerable room for doubt whether such voluntary insurance will solve the problem of the relative inadequacy of medical

care among certain sections of the community.

Discussion of the most frank and personal character is necessary and advisable. We must remember that, in the broad view, a physician is not a private enterprise, seeking only his own self-interest, but a servant of the community, and that his professional life must ultimately be organized along lines which will best satisfy the community needs rather than the desires and ambitions of the individual practitioner.

A dogmatic objection to anything that smacks of compulsion (even though it includes many voluntary features) will not serve to defeat legislative proposals for socialized medicine. The element of compulsion already exists in regard to many actions which by courtesy we call voluntary. An excellent example, as Butler points out, is the ubiquitous Community Chest, to which important groups of the community are practically forced to contribute. We are hardly disposed to regard as entirely objectionable the national income-tax law, with its extreme features of compulsion. Social Security has come to stay. Education is a form of compulsion. The fact is that democracies can only live and prosper by innumerable compulsions based upon the will of the people and of their elected representatives. The extent to which compulsion is applied depends in the last resort upon the popular judgment and the popular will.

Rightly or wrongly, most physicians are apparently disposed to regard the Wagner-Murray-Dingell Bill, particularly in its medical provisions, as an extreme measure. But many physicians, without more than the most superficial knowledge or understanding of this lengthy and complicated legislative proposal, themselves indulge in extreme forms of criticism and condemnation. In

the long run, an unwillingness to tolerate open discussion of detail as well as principle would bring us neither credit nor advantage. W. H. Crisp.

### AGENCY-DISPENSING PRACTICES

Allegedly with the idea of eliminating or at least reducing subterfuge, and after discussion with many persons, and possibly also in order to comply with Government regulations without embarrassment to refractionists, and probably to induce refractionists to send their prescriptions to them to be filled, certain companies have adopted a policy which they call agency dispensing. This consists in a written agreement between the licensed refractionist and the optical company by the terms of which the refractionist appoints the company as his agent for the dispensing of eye glasses to the refractionist's patient and authorizes the company to collect from the patient for the refractionist a sum designated by him in payment for the merchandise. The company credits the account of the refractionist with the money paid by the patient and sends any balance in this account at the end of each month to the refractionist or to any individual or organization designated by the refractionist. The refractionist indicates to the dispenser the method of collection to be employed in the individual case, whether the transaction is to be on a cash or a credit basis. The risk of credit is assumed by the refractionist. All material and service charges are immediately charged to the refractionist's account for whom the agent acts. The agent credits the account of the refractionist with any money collected from the patient and the resulting credit balance, if any, is sent to the refractionist at the end of each month. The dispenser assumes the task of the interim

care of the adjusting of the patient's glasses at no further cost to the patient. If, however, the refractionist desires to make a change in the prescription for which he thinks the patient should not pay additionally—for example, if the refractionist makes a change in the lenses within a few weeks after the original prescription because the patient is not comfortable with the new lenses—the cost of such replacements is charged to the refractionist's account.

A notice is displayed in the office of the dispenser that is worded as follows: "Glasses are dispensed only on Rx of and as agent for licensed refractionists." A receipt is given to the patient which states that, ". . . dollars, have been received for the account of Dr. . . ."

This agency-dispensing policy has been discussed previously in the Journal, but since it is a matter of extreme importance to ophthalmologists, some reiteration and enlargement of the scope of the discussion seems warranted. It is obvious that there are many cities in the United States which do not now have dispensing opticians who perform no refractions themselves. The Guild of Prescriptions Opticians, whose code precludes the refractioning of patients by its members, has an enrollment of approximately 225 firms. The problem of how ophthalmologists who do not live in communities in which nonrefracting opticians are located shall handle their prescriptions for glasses has always been one extremely difficult of solution. The method of purchasing supplies from the lens wholesaler and himself assuming the task of fitting the frames, making the constant adjustments, and undertaking the financial responsibility for the commercial element in the transaction has been one that has been distasteful to numerous ophthalmologists. Many of these have welcomed the agency-dispensing plan as being a simple

solution to their difficulties in that it provides excellent service to the patient at no cost above that of the average dispensing optician, and it can scarcely be doubted that it has been employed by many ophthalmologists as a means of additional remuneration for the ocular care of the patient.

It is the contention of the writer that any practice that gives a hidden fee to the physician, whether it be through the dispensing of glasses, orthopedic appliances, hearing devices, or drugs, the referring of patients to unscrupulous morticians or shyster lawyers for a monetary consideration, is unethical. This, however, is an entirely negative approach to the subject. The young ophthalmologist must have positive guidance. It, therefore, devolves upon those who formulate policies for organized medicine to advise young men placed under a variety of circumstances and conditions how they should proceed. The question arises whether it is possible for the agency-dispensing policy to be so conducted as to be acceptable to those who abide strictly by the provisions of the policy currently in effect in the American Medical Association, or not. It would seem that this could be done if the opticians engaging in this practice would take the stand that they would not return to the doctor any balance that might accrue in the doctor's account, but would utilize it to reduce the general cost of glasses to the public. Or, if this policy would meet with too much opposition from non-refracting opticians and optometrists for it to be tenable, as seems not unlikely because it would inevitably lead to a general reduction in the retail price of glasses, it could still be agreed between refractionists and dispensers and openly proclaimed to patients that any monies accumulating to the credit of the individual doctor would not be given to this

doctor, but would be paid to any recognized charity or educational organization designated by the doctor. This would remove the onus of improper action from the doctor, but would not help in the fundamental problem of decreasing the cost of glasses to the patient and probably would not be very satisfying to the patient, who would consider that any excess profit should be removed from the transaction.

If it can be shown that those utilizing the agency-dispensing policy charge less than those who do not use it because of the credit that the agency gives them, this would be a good talking point for those advocating the plan; but evidence of this is practically impossible to obtain.

It seems to the writer that the ophthalmologist who practices in a city where no optical service is available which merely fills the prescriptions without entering into any financial agreement with the refractionist would be acting as ethically as possible if he added a clause to his contract with the agency-dispensing organization in which it is stated that it has been agreed that he would not personally participate in any profit from the sale of glasses, but that any such profit accruing to his credit would be contributed at his designation to some recognized charitable or educational institution. This would keep the eye physician's relationship with his patient on the high plane on which it belongs and retain the confidence of the public in the integrity of the doctor. By implication it might be argued that his having any type of contract with an agency-dispensing company implied a tacit agreement with the underlying policy of that company. However, if he has no alternative but to utilize these companies, his action would certainly be considered the best possible one under the circumstances and therefore above criticism.

If these suggestions should prove as

unpopular as the writer imagines they will, the least that dispensers and refractionists should do would be to inform the patient in unequivocal language that the refractionist was receiving a remuneration of unspecified amount in addition to the fee paid by the patient directly to him. As the matter now stands, it seems that the signs in the optician's office and the receipts given to the patients are too ambiguous to convey this information to many of those who are the unsuspecting third parties in these transactions. With tongue in cheek the writer would suggest substituting the word "prescription" for the technical "Rx" and adding a phrase so that the notice in the agency office shall read: "Glasses are dispensed only on prescription of and as agent for licensed refractionists who may participate in any profit that might accrue from this transaction."

Lawrence T. Post.

## BOOK NOTICE

### INDUSTRIAL OPHTHALMOLOGY.

By Hedwig S. Kuhn, M.D. Cloth-bound, 294 pages, 114 text illustrations including two color plates. St. Louis, C. V. Mosby Co., 1944. Price \$6.50.

This excellent book will be of unusual interest to all who practice industrial ophthalmology and truly an eye opener to those not engaged directly in this type of work. The importance of complete familiarity on the part of the ophthalmologist with the problems of industries and his actual occasional presence in the plants, to the employees of which he gives service, is brought home strikingly to the reader. Most ophthalmologists probably never visit industrial plants with a view to helping solve the eye problems connected with them, but merely perform refractions, when the employees are sent from

the factories, and take care of injuries, and occasionally represent the company or the individual in court.

The possibility of being of service in the plants and to the workers therein by instituting good lighting, advocating the use of protective goggles especially adapted for the work for which they are to be used, and the prescribing of spectacle lenses arranged for the proper working distances of the individual are subjects carefully considered by the author. The material used in preliminary examination, the need of special test objects such as those for stereopsis, color, and others for particular types of work, are outlined. Considerable space is given to the evaluation of visual defects in the production of accidents. The reader will be convinced that his expert advice, provided he has educated himself properly to give such advice, will be of great importance to the plant in increasing production and saving lost hours from ineffective work due to poor vision and in the prevention of accidents.

An excellent chapter on industrial injuries from solid bodies has been written by Dr. Albert C. Snell. Prophylaxis and treatment are included. Many seemingly trivial but undoubtedly important points are brought out in the chapter on eye protection. Attention is called to such matters as the care of goggles and the importance of having clean paper or antifogging solution readily available. Another point is the value of the constant attendance in large plants of an optician with an instrument carriage that can be moved from worker to worker for the adjustment of the spectacles, for the repair of breaks, and in general for servicing spectacles.

Considerable discussion is given to welding, also to actinic or flash conjunctivitis and epidemic keratoconjunctivitis.

In the appendix are discussed toxic

hazards, and there is a glossary of terms. A program for industry is outlined and, finally, the appraisal of loss of visual efficiency as approved by the Section of Ophthalmology of the American Medical Association in 1940 is added. There is a good index and the book is well illustrated throughout. Lawrence T. Post.

## CORRESPONDENCE

### RECESSION OF THE INFERIOR OBLIQUE

April 22, 1944

Editor,

American Journal of Ophthalmology:

The article by Dr. George P. Guibor entitled, "Recession of the inferior-oblique muscle from the external-rectus approach," in the March, 1944, number of the American Journal of Ophthalmology, would seem to call for some comment.

No exception is taken to the advisability of the operation or the results obtained, but the technique described is unnecessarily cumbersome and complicated and has no advantage over the technique described and illustrated by Dr. James W. White in the American Journal of Ophthalmology (1943, v. 26, pp. 586-591). From reading Dr. Guibor's article one might easily draw the conclusion that to recede the inferior oblique at or near its insertion one must divide and reflect the lateral rectus. This is by no means the case. Recession of the inferior oblique can be done without disturbing the lateral rectus, except to retract it gently upward, and, for the best results, I believe it should be done without disturbing the inferior-rectus. There is no advantage in having the inferior oblique and the inferior rectus matted together by scar tissue. If the conjunctival incision is made in the manner described by Dr. White, there is no excuse for cut-

ting the inferior rectus by mistake, although Dr. White recently stated that he had seen four cases where the inferior rectus had been cut when the operator believed he had been tenotomizing the inferior oblique, and men who work with him had seen four other similar cases. I have seen one such case recently. To repair such a mistake is a life-sized job and I doubt if it can be done perfectly, particularly after the contractures which result are well established.

Dr. Guibor may intend to discuss the advancement or shortening of the inferior-oblique in a subsequent article but attention should be called to the fact that the inferior oblique can be successfully shortened through the same approach, as pointed out by Dr. White (Trans. Sect. Ophth. A.M.A., 1941, p. 308, and again in Trans. Pac. Coast Oto-Ophth. Soc., 1941, p. 112, "A review of twenty-seven years with the obliques"). Dr. Robert Irvine, of San Francisco, told me recently that he had been able to shorten the inferior oblique at its insertion by O'Connor's method. [ED. NOTE: see page 644 of this issue.]

The student who is interested in the *indications* for surgery on the obliques would do well to read Dr. White's paper entitled, "Indications for treatment for combined lateral and vertical strabismus" (Arch. of Ophth., 1933, v. 10, Nov., pp. 585-592).

One feature of the inferior-oblique muscle which has perhaps not been sufficiently stressed is its peculiar innervation. On theoretic grounds, it would seem wise to work "at or near" the insertion or else at the origin, as recommended by Wheeler ("Advancement of the superior oblique and inferior oblique ocular muscles." Amer Jour. Ophth., 1935, v. 18, Jan., p. 1). No case has to my knowledge been reported where shortening of the inferior oblique has resulted in complete



paralysis of this muscle, but it is something to keep in mind if one is tempted to operate in the neighborhood of the belly of the muscles or to dig too deep in the floor of the orbit.

It will occur to everyone that a good time to practice picking up the obliques at their insertion (if the eye is not too inflamed) is when obliged to do an enucleation. To pick up the obliques at

their insertions and sever them there actually facilitates an enucleation and it gives some experience that is valuable when one contemplates either a recession or an advancement of the inferior oblique or an advancement of the superior oblique at their insertions.

(Signed) George N. Hosford, M.D.

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San Francisco 8, California.

## ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

### CLASSIFICATION

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|--|--|
| 1. General methods of diagnosis                        | 10. Retina and vitreous                                |
| 2. Therapeutics and operations                         | 11. Optic nerve and toxic amblyopias                   |
| 3. Physiologic optics, refraction, and color vision    | 12. Visual tracts and centers                          |
| 4. Ocular movements                                    | 13. Eyeball and orbit                                  |
| 5. Conjunctiva   | 14. Eyelids and lacrimal apparatus                     |
| 6. Cornea and sclera                                   | 15. Tumors   |
| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries   |
| 8. Glaucoma and ocular tension                         | 17. Systemic diseases and parasites                    |
| 9. Crystalline lens                                    | 18. Hygiene, sociology, education, and history         |
|  | 19. Anatomy, embryology, and comparative ophthalmology |

#### 1

#### GENERAL METHODS OF DIAGNOSIS

Allen, Lee. A new contact lens for viewing the angle of the anterior chamber of the eye. *Science*, 1944, v. 99, March 3, p. 186.

A plastic contact lens of entirely new design, for use in gonioscopy, is described by the author. This new lens has a concave surface which lies apposed to the cornea, from which it is separated only by a thin film of tears. At the sides are (1) a convex refracting surface which permits direct visualization of the chamber angle, and (2) a plane reflecting surface which utilizes total internal reflection so as to permit

examination of the angle by looking through the flat top of the plastic block. An easily flexible wire spring holds the lens in place without injury to the cornea. Benjamin Milder.

Cherif, M. de R. Ocular biomicrophotography. *Anales de la Soc. Mexicana de Oft. etc.*, 1942, v. 17, Sept.-Oct., pp. 167-174.

The author describes an apparatus for slitlamp photography which he has found satisfactory. This is an adaptation of the ocular of the microscope and a cardboard box making a dark chamber. Focusing is done by sliding two cardboard tubes one within the other.

For details one should consult the original. (6 figures.) Eugene M. Blake.

Harris, R. H. Comparison of the Ishihara and the American Optical Company series of pseudoisochromatic plates. *Arch. of Ophth.*, 1944, v. 21, Feb., pp. 163-164. (See Section 3, Physiologic optics, refraction, and color vision.)

Koch, F. L. P. A color filter for retinal photography. *Amer. Jour. Ophth.*, 1944, v. 27, March, pp. 281-282.

Koch, F. L. P., and Williams, A. F. A modified film adapter for retinal photography. *Amer. Jour. Ophth.*, 1944, v. 27, April, pp. 403-407. (4 illustrations, references.)

Livingston, P. C. The form and character of rod scotometry. *Amer. Jour. Ophth.*, 1944, v. 27, April, pp. 349-353. (One figure, 5 fields.)

Low, F. N. The peripheral visual acuity of 100 subjects. *Amer. Jour. Physiology*, 1943, Oct. 1, pp. 83-88.

Peripheral visual acuity may be trained, and is largely independent of central vision. One hundred persons (87 males and 13 females) aged 17 to 70 years, including eight color-blind, were examined with a special apparatus to test their peripheral visual acuity. The apparatus consisted of a 25-cm. perimeter with especially constructed illuminator, target carrier, targets, and test objects. Nine points on the temporal peripheral field of each eye were tested in each meridian, the meridians being 45 degrees apart. Fixation was checked by the examiner observing the subject's eye. Each eye was tested separately, the whole test requiring from 40 to 60 minutes. The variation of

peripheral visual acuity varies widely, the best subject being about  $3\frac{1}{2}$  times the normal and  $8\frac{1}{2}$  times the most subnormal. On the whole, these tests verify the well-known visual acuity curves of Wertheim. Charles A. Bahn.

Simonson, E., Fox, M. S., and Enzer, N. Influence of vestibular stimulation on the fusion frequency of flicker in normal subjects and in patients with postconcussion syndrome. *Arch. of Otolaryng.*, 1943, v. 38, Sept., p. 245.

The resting value of the fusion frequency of flicker was determined for 16 normals and 16 postconcussion patients. Of the latter, eight showed depression. Caloric vestibular stimulation was then found to have decreased the fusion frequency of flicker in the 16 normal subjects, but to have increased it in 14 of the 16 patients with postconcussion syndrome. This deviation occurs later and lasts longer than the reactions of nystagmus and dizziness, and reveals pathologic deviations in a greater number of subjects than the use of the nystagmus reaction alone. The test is thought by the authors to be a useful clinical test.

Robert N. Shaffer.

## 2

### THERAPEUTICS AND OPERATIONS

Berens, Conrad. An illuminated retractor for eye operations, especially for detachment of the retina. *Amer. Jour. Ophth.*, 1944, v. 27, March, p. 281. (One figure.)

Falls, H. F. A word of caution in use of pentothal sodium in ophthalmic surgery. *Arch. of Ophth.*, 1944, v. 31, Feb., pp. 134-137.

Pentothal sodium, a short-acting barbiturate, has been quite popular as

a general anesthetic for intravenous administration. The drug is potentially dangerous, since it has a depressing effect on the medullary respiratory center. There is a lack of adequate signs of impending respiratory failure, making the margin of safety too narrow to permit its unqualified use. Intravenous administration of the drug makes it possible for the anesthetist to be out of the surgeon's way. This, combined with the ease and rapidity of induction, makes it a convenient anesthetic. Its use is contraindicated in children, in patients with renal or hepatic disease, and in cases of increased intracranial pressure. The drug is not suitable for long surgical procedures which require deep muscular relaxation.

The author summarizes the results obtained from the administration of pentathal sodium in 147 consecutive and unselected ophthalmic operations. Apnea occurred in eight cases, in one of which it terminated in death. The case histories of the patients developing apnea are given in some detail. The fatality occurred in a man of 76 years during enucleation for a painful secondary glaucoma. Respiratory failure developed after cessation of painful stimuli. Artificial respiration, oxygen under pressure, intracardiac injection of epinephrine, injection of nikethamine and painful peripheral stimulation failed to restore respiration. The patient had severe generalized arteriosclerosis and arteriosclerotic heart disease. Recovery was satisfactory in the other seven cases of apnea. One of the patients ceased breathing after having been taken to the ward, illustrating the necessity of observing the patients for some time. Other complications observed included postoperative restlessness, nausea, vomiting, and coughing. The author states that the severe cases

of apnea resulted from faulty administration but illustrate the potential danger of the drug. Method of administration and care of complications are discussed. (5 tables, references.)

John C. Long.

Fitzpatrick, Roberto. *Mydriasis medicamentosa*. *Anales de la Soc. Mexicana de Oft. etc.*, 1943, v. 18, Sept.-Dec., pp. 37-42.

A historical review of the development and use of cycloplegic and mydriatic drugs and their application to various purposes in ophthalmology. (References.) Eugene M. Blake.

Foster, J. *Preoperative cultures and antisepsis*. *Trans. Ophth. Soc. United Kingdom*, 1942, v. 62, pp. 329-335.

After many years of routine conjunctival culture preceding cataract operation, the author began to doubt the value of the practice as no infections developed in other intraocular operations for which routine cultures were not made. In cataract cases that became infected there was good reason to suspect that the patients had introduced infection by poking their fingers under the bandage. Colleagues who did not make conjunctival cultures had no difficulties with infection. The writer suggests that the use of preoperative antisepsis tends to reduce the resistance of the eye. He states other reasons for reduction in postoperative infection, including improved method of instrument sterilization, better selection of cases, improved treatment of such general conditions as anemia and diabetes, the wearing of masks by surgeons with upper air-passage infection, improved operative technique, and eye shields which reduce access by the patient's fingers to the eye. (3 tables, references.) Beulah Cushman.

García Miranda, A. Avitaminosis in ophthalmology. *Arch. de la Soc. Oft. Hisp. Amer.*, 1942, v. 1, Oct., pp. 344-377.

This is an up-to-date review of the present status of vitamins in ophthalmology. The role played by vitamins A, B complex, C, D, E, and K in ocular affections is thoroughly discussed.

Ramón Castroviejo.

Gundersen, T., and Liebman, S. D. Effect of local anesthetics on regeneration of corneal epithelium. *Arch. of Ophth.*, 1944, v. 31, Jan., pp. 29-33. (See Section 16, Injuries.)

Keyes, J. L. Recent advances in clinical ophthalmology. *Ohio State Med. Jour.*, 1943, v. 39, Dec., p. 1110.

Indications, effectiveness, dosages, and contraindications to the use of the sulfonamides and penicillin in ophthalmologic conditions are discussed.

Thygeson's summary of the use of the sulfonamides in the viruses of trachoma, inclusion conjunctivitis, and lymphogranuloma, and in ocular infections due to gonococcus, meningococcus, alpha and beta hemolytic streptococcus, staphylococcus, pneumococcus, influenza bacillus, diplobacillus, coliform rods, Friedländer's bacillus, and pyocyaneus bacillus is quoted.

Sulfadiazine is the drug of choice for internal medication. Local application of 5-percent sulfathiazole or sulfadiazine in an ointment composed of 100 percent hydrous wool fat is most effective, although a base of 25-percent hydrous wool fat and 75-percent petrolatum is nearly as efficient. Local drops of 3 to 5-percent sodium sulfathiazole (water-soluble) is useful, although occasionally irritating after prolonged use because of the alkaline

pH. Adequate dosage of any of the sulfonamides, used orally, and adequate duration of therapy are stressed because of the risk of developing a sulfafast strain of infecting organisms, or of the danger of a relapse.

Optimum blood-sulfadiazine levels lie between 7 and 13 mg. per 100 c.c. In adult males of army age this is best assured by an initial dose of 4 gm. and subsequent dosage of 1 gm. every four hours for the first 24-hour period. Once the level is established it can usually be maintained by 1 gm. every five or six hours. Alkalinization is maintained by roughly corresponding doses of sodium bicarbonate. Sodium citrate is substituted the third day if the urine is alkaline to litmus paper.

Penicillin so far is effective locally and systemically in infections caused by streptococcus hemolyticus, staphylococcus aureus, pneumococcus, gonococcus, meningococcus, B. diphtheriae, and Koch-Weeks bacillus. Further analogy between penicillin and the sulfonamides is noted in that organisms may become fast to either drug, and also that bacteriostatic rather than bacteriocidal action is characteristic of each.

The activity of penicillin is greatly reduced in the presence of colon bacilli. Instillation and parenteral use of penicillin are effective. Concentrations of penicillin up to 5,000 units per c.c. are tolerated in eye instillations. Instillation every half to one hour is advised for acute phases, with gradual diminution until several days after clinical cure. Intravenous and intramuscular dosages of penicillin range from 5,000 to 15,000 units administered every two or three hours, with a total maximum dosage of 120,000 units in 24 hours.

Hospitalization for treatment with penicillin is advised, because of the

scarcity of the drug and its rapid tendency to deteriorate.

Owen C. Dickson.

Knight, H. C., Emory, M., and Callahan, N. Hyperpyrexia in the treatment of acute ocular inflammations. *Amer. Jour. Ophth.*, 1944, v. 27, April, pp. 381-388. (5 tables, references.)

Steinhaus, A. H., and Kelso, A. Improvement of visual and other functions by cold hip-baths. *War Med.*, 1943, v. 4, Dec., p. 610.

Cold hip-baths lasting 10 to 20 minutes are shown to produce striking temporary improvement in binocular vision, visual acuity, critical fusion frequency, and psychomotor reactions. These baths have been maintained at least six hours without after-depression being observed. It is suggested that they be tried in those aspects of warfare and industry that involve monotonous routine duties demanding acute vision and alert performance.

Robert N. Shaffer.

Von Sallmann, L., and Meyer, K. Penicillin and sulfadiazine in the treatment of experimental intraocular infections with *Staphylococcus aureus* and *Clostridium welchii*. *Arch. of Ophth.*, 1944, v. 31, Jan., pp. 54-63.

The authors' study, previously reported, of the chemotherapy of intraocular infections of the anterior segment with *Diplococcus pneumoniae* has been extended to infections with *Staphylococcus aureus*, which in frequency stands second to *D. pneumoniae* as a cause of posttraumatic and postoperative purulent endophthalmitis. *Clostridium welchii* was selected as a representative of the anaërobe group. The effect of oral administration of sulfadiazine in combination with the

topical use of its sodium salt was again compared with that of local treatment with penicillin.

The inoculation was carried out as follows: The needle was introduced into the anterior chamber near the limbus at the 12-o'clock position, and a large, deep slit was made in the anterior cortex of the lens. Aqueous was withdrawn into a syringe, and, after proper adjustment of the stopcock, the net amount of 0.05 c.c. of a  $10^{-4}$  dilution of an 18-hour broth culture was injected into the anterior chamber. The number of viable organisms injected, as calculated by plate counts, varied from 5,000 to 10,000. After withdrawal of the needle an attempt was made to seal the puncture canal with a heated probe. Treatment was initiated six to seven hours after inoculation, and consisted of iontophoretic introduction of sulfadiazine or penicillin.

The clinical and histologic inflammatory changes observed six hours after inoculation of the eyes of rabbits were caused in great part by the trauma of the injection. To this category belong a dense fibrinous exudate in front of the pupil, dilatation of the capillaries in the iris and the ciliary body, an obvious increase in protein content of the aqueous, the presence of a few polymorphonuclear leucocytes in the iris and the anterior chamber, and a characteristic edema of the ciliary processes in the form of numerous Greeff blebs.

The authors conclude that the technique described is a reliable standard lesion for chemotherapeutic experiments as to *Staph. aureus*. Combined oral and topical use of sulfadiazine was beneficial in 21.7 percent of the eyes with purulent endophthalmitis so produced, if treatment was initiated six to seven hours after inoculation. Penicillin, applied topically with the first

treatment six to seven hours after inoculation, controlled the infection definitely in 62.5 percent and possibly in 75 percent of the eyes.

Intralenticular injections with *Cl. welchii* caused destructive endophthalmitis; and neither sulfadiazine nor penicillin therapy begun six hours after such injections had any effect on the resulting endophthalmitis. (References.)  
R. W. Danielson.

Von Sallmann, L., and Meyer, K. Penetration of penicillin into the eye. *Arch. of Ophth.*, 1944, v. 31, Jan., pp. 1-7.

The good results from penicillin in treatment of some experimental intraocular infections of the anterior segment of the eye, and the antibacterial activity of penicillin in vitro against most organisms found in intraocular infections, suggested a study of the penetration of penicillin into the anterior chamber.

The investigations on the topical use of penicillin deal, first, with the entrance of penicillin into the aqueous of rabbits after iontophoresis as compared with that after the corneal bath; second, with the influence of wetting agents on the penetration of penicillin; and, finally, with the possibility of its introduction by repeated use of solutions or ointments with and without wetting agents. The studies on systemic application are limited to determinations of penicillin in the blood, the spinal fluid, and the intraocular fluids after single intramuscular injections.

Iontophoretic introduction of a 0.25-percent solution of sodium penicillin into the aqueous led in 45 minutes to maximal concentration of 40 micrograms per c.c. The average for this maximal concentration was about three times as great as that obtained with a

solution of 0.1-percent sodium penicillin and was almost ten times as great as the average concentration in the aqueous 45 minutes after a single corneal bath with a 0.25-percent solution. A small amount of penicillin was found in the aqueous after four hours only, following iontophoretic introduction of a 0.25-percent solution. The increased speed of penetration under the influence of an electric current is demonstrated by the results of determination of penicillin in the aqueous 15 minutes after application. Whereas no trace of penicillin was detected after a corneal bath, the presence of 16.6 micrograms per c.c. was estimated after ionization with a 0.25-percent solution. No detectable amount of penicillin was found in the vitreous withdrawn in two experiments one hour after the transcorneal iontophoretic introduction of a 0.25-percent solution of sodium penicillin.

Furthermore, a comparison of the two groups of experiments demonstrates that the use of nupercaine as a local anesthetic is almost as effective in increasing the penetration of penicillin into the anterior chamber as is the addition of wetting agents to the penicillin solution in its application with general anesthesia. As these experiments were confined to the use of two surface-tension depressants, no generalization can be made as to the value of other wetting agents for use with penicillin.

Repeated applications of solutions and ointments containing penicillin did not produce any detectable antibacterial activity of the aqueous. The addition of wetting agents was without effect. Small amounts of penicillin entered the aqueous from the blood stream. Secondary aqueous contained several times as much penicillin as

primary aqueous. (3 graphs, references.)  
R. W. Danielson.

Wegener, H. P. **Toxic effects of sulfonamides on the eyes.** *Amer. Jour. Med. Sciences*, 1943, v. 206, Sept., pp. 261-268.

The author reviews in detail the literature on this subject. It has been proved that the sulfonamides are present in all of the ocular tissues in a concentration somewhat below the blood level. One of the commonest reported toxic manifestations is a change in refraction, an induced myopia that is usually very transient and is probably due to edema of the lens. Another common finding is transient edema and irritation of the lids and conjunctiva. Rarer, but important, lesions reported are optic neuritis and hemorrhagic retinitis. In most of these cases recovery occurred without permanent damage. In some studies in normal individuals it was found that there was no significant change in the visual acuity and peripheral field, but definite effect on the muscle balance and depth perception was noted. All of these studies showed no significant difference in the toxicity of the various sulfonamides.

T. E. Sanders.

### 3

#### PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Berens, C., and Sells, S. B. **Experimental studies on fatigue of accommodation.** *Arch. of Ophth.*, 1944, v. 31, Feb., pp. 148-159.

Accommodative fatigue was studied on 57 clinic patients complaining of ocular fatigue or other symptoms of asthenopia. Twelve different experiments were carried out on these patients, fatigue being produced by the use of the Howe-Berens ophthalmic

ergograph. The data are recorded in detail in 13 tables. It was observed that a period of exercise on the ophthalmic ergograph resulted in a recession of the near point. This is regarded as evidence of fatigue of accommodation. When the experiments were conducted with one eye occluded it was found that both eyes manifested fatigue, the occluded eye to a lesser degree than the "working eye." (2 figures, 13 tables, references.)  
John C. Long.

Hamilton, W. F., Briggs, A. P., and Butler, R. E. **The testing of color vision in relation to vitamin-A administration.** *Amer. Jour. Physiology*, 1944, v. 140, Jan. 1, p. 578.

That vitamin therapy may affect retinal pigmentation and enable a subject to pass color-vision tests as he can do with rose-colored glasses is not impossible. If it did so, however, it would not improve wave-length discrimination.

Tests revealed no change in dichromats after massive vitamin-A therapy. The Ishihara test gave a correct diagnosis, since the cases were classified as green-blind and by examination with spectral light they were dichromats with a long spectrum.

Twelve of the "Ishihara-blind" subjects were trichromats who could discriminate colors throughout the spectrum. About one half of these men had thresholds close to the average of the population, and one half somewhat higher in the orange to green. Only one of the 13 subjects showed a change from partially red-green blind to normal under large doses of vitamin A, and he lapsed to the original diagnosis when his blood concentration returned to its original level.

About one half of the group discarded under the Ishihara test can be



shown to have normal wave-length discrimination. The authors feel that this group, although able to see and name the colors of the dots, are unable to arrange them into a figure. Failure then is in building up a mental pattern and seems to be psychic rather than sensory. Some of the men who see the figure have less wave-length acuity than some who do not.

Evidence therefore leads to the conclusion that the Ishihara and similar tests do not tell whether the individual can discriminate hue, but gave rather confused information as to whether he is or is not anomalous in the manner in which he arranges his visual field into patterns. Owen C. Dickson.

Harris, R. H. Comparison of the Ishihara and the American Optical Company series of pseudoisochromatic plates. *Arch. of Ophth.*, 1944, v. 31, Feb., pp. 163-164.

Examination of color vision was carried out on 1,471 applicants for army air crew training by use of both the Ishihara series of plates and the plates of the American Optical Company. The applicant failed if he missed 25 percent or more of the plates in either series. It was found that 6.6 percent failed with the Ishihara tests, while 5.7 percent failed with the American Optical Company plates. It is concluded that the Ishihara series of plates meets the demands better than the American Optical Company plates because with the former the examination is less time-consuming and the elimination of candidates with subnormal color perception is more thorough. Further, the plates are less easily available to color-deficient candidates who wish to become familiar with them for the purpose of passing the examination.

John C. Long.

Reeder, J. E., Jr. The psychogenic color field. *Amer. Jour. Ophth.*, 1944, v. 27, April, pp. 358-361. (4 fields, 1 table.)

Sloane, A. E. Refraction clinic. *Amer. Jour. Ophth.*, 1944, v. 27, April, pp. 407-409.

#### 4

#### OCULAR MOVEMENTS

Argañaraz, Raul. Ocular torticollis. *Arch. de Oft. de Buenos Aires*, 1942, v. 17, July, p. 379.

The importance of ocular torticollis is stressed. The actions of the rectus and oblique muscles are explained in detail as the basis of the mechanism of production of the vicious positions of the head in vertical strabismus. Ocular torticollis is found associated with paralytic vertical strabismus and with functional vertical strabismus. The first variety is more frequently related to paralysis of the superior oblique, although underaction of any of the other vertical muscles can produce it. It is due to a reflex stimulus originating in the labyrinth and semicircular canals in order to maintain the correct position of the planes of the eye. The torticollis associated with functional or spastic vertical strabismus is more frequently caused by spasm of the inferior oblique, but spasms of the superior or inferior rectus muscles may also give rise to it. The underlying cause is not a paralysis, but a permanent spastic contracture of the muscle. (Illustrations, photographs.)

Plinio Montalván.

Malbrán, Jorge. Concerning paralysis of the inferior oblique. *Arch. de Oft. de Buenos Aires*, 1942, v. 17, June, p. 337.

The extreme rarity of individual paralysis of the inferior oblique muscle is stressed, and the literature on the subject is reviewed and brought up to date. The author then reports six cases of paralysis of the inferior oblique which have come under his observation. In the first case, which occurred in a 16-year-old girl during epidemic parotitis, the paralysis was limited to the right inferior oblique, without involvement of the other extraocular muscles, while in the remaining five cases the paralysis was accompanied by convergent strabismus. (Bibliography, photographs.)

Plinio Montalván.

## 5

### CONJUNCTIVA

Almeida Toledo, Silvio de. **Considerations as to the etiology of trachoma.** *Arquivos Brasileiros de Oft.*, 1943, v. 6, Oct., pp. 163-192.

This thirty-page article is a review of the literature of the subject, with a bibliography of 73 references.

Director, William. **Fixed eruption conjunctivitis and fever from sulfathiazole.** *Arch. Derm. and Syph.*, 1943, v. 48, Nov., p. 523.

Cutaneous reactions from sulfonamide compounds are not infrequent, but conjunctivitis, as a reaction, is less common. The author reports one case of fixed dermatitis, conjunctivitis, and fever. The term "fixed" is used in the sense that in recurrences the dermatitis is confined to the same site.

A diagnosis of lymphogranuloma venereum was established and sulfathiazole was given daily. One day after therapy was started macules appeared on the neck. Papules appeared on the forehead, and both conjunctivas be-

came diffusely injected. After the fourth day sulfathiazole was discontinued. The drug lesions faded the next day, and two days later they were almost completely gone.

After recurrence of the swelling in the left inguinal lymph nodes the patient again was given a total of 3.5 gm. of sulfathiazole for two days. At noon of the second day there was a recurrence of the eruption on the same sites as had been previously affected. The use of sulfathiazole was discontinued. Twenty-four hours later the eruption had subsided, only slight erythema remained, and the conjunctival injection had completely faded.

The patient was given 0.5 gm. of sulfathiazole and the following observations were made. (1) Elevation of temperature, with malaise, appeared first after an interval of 4 hours and 15 minutes, rose slowly to 102.6 F. in 2 hours, remained there for 3 hours, and slowly subsided to normal in 6 hours; a total febrile period of 11 hours. (2) Conjunctival injection and dermatitis of fixed sites on the neck and forehead appeared together after a latent period of 5 hours and 45 minutes. The injected conjunctival vessels appeared first at the inner canthi and spread laterally. The injection disappeared completely in 24 hours. Dermatitis subsided completely in 36 hours. From the clinical description it appeared that the shock organ of the skin and conjunctiva was vascular, the reaction consisting of dilatation of the small vessels of the conjunctiva and vasodilatation and increased permeability of the small vessels of the corium in the area affected by dermatitis.

Theodore M. Shapira.

Griffey, W. P. **Penicillin in treatment of gonorrheal conjunctivitis.**

Arch. of Ophth., 1944, v. 31, Feb., p. 162.

A man aged 24 years developed a gonorrheal urethritis and conjunctivitis which proved resistant to sulfathiazole. Treatment consisting of sulfathiazole and intravenous injections of typhoid vaccine were carried out over a period of about six weeks. At the end of this treatment the urethral discharge had subsided considerably but the ocular infection with a copious purulent discharge persisted. The gonococcus could be demonstrated by smear and culture from both the conjunctiva and urethra. Treatment was then changed to the intramuscular injection of penicillin sodium. Twenty-five thousand units were injected every three hours for a total of ten injections. Hourly cultures of the conjunctiva and urethra were made. These cultures were positive for the first five hours, after which time they were persistently negative. Marked improvement was noted in the clinical appearance of the eye within ten hours of beginning treatment. Prompt and complete recovery took place. (4 photographs.)

John C. Long.

Lever, W. F. Pemphigus conjunctivae with scarring of the skin. Arch. Derm. and Syph., 1944, v. 49, Feb., p. 113.

Three cases of conjunctival pemphigus are presented. The literature contains reports of only eight similar cases. The author considers this a distinct variety of pemphigus because of its chronic and benign course, predilection of lesions for mucous membranes, particularly the conjunctiva, and their tendency to form scars. The lesions always scar the conjunctiva. Frequently the other mucous membranes, and oc-

casionally skin, develop similar terminal changes. Robert N. Shaffer.

Lever, W. F. Severe erythema multiforme . . . development of cicatricial conjunctivitis and dermatitis in one case. Arch. Derm. and Syph., 1944, v. 49, Jan., p. 47.

Severe erythema multiforme starts abruptly with high fever and important constitutional signs. An extensive predominantly bullous eruption of the skin and mucous membranes develops within a few days. Despite the severe clinical picture fatalities are rare. Recovery is usually complete in a few weeks. The only area where permanent damage may result is in the eyes, where conjunctivitis is common. In mild form no harm is done, but the severe varieties may lead to conjunctival scarring, corneal ulcers, and panophthalmitis. In the chronic stage the picture is identical with that of pemphigus conjunctivae. Two cases here reported had ocular involvement.

Robert N. Shaffer.

Thygeson, Phillips. Primary meningococcic conjunctivitis treated by sulfadiazine. Amer. Jour. Ophth., 1944, v. 27, April, pp. 400-401.

## 6

### CORNEA AND SCLERA

Anthony, E. W., and Marshall, D. Erythema nodosum episcleritis. Amer. Jour. Ophth., 1944, v. 27, April, pp. 398-400. (One illustration, references.)

Belfort Mattos, W. Syphilis of the sclera. Arquivos Brasileiros de Oft., 1944, v. 6, Oct., pp. 157-162.

Two cases are reported. A girl of fifteen years, of good family, came first in September, 1930, on account of a

refractive error. She had been having an annual course of antiluetic treatment, but was intolerant to bismuth and also to the arsenicals. She was seen on two subsequent occasions, without important change of condition. In December, 1932, she came with an incipient iritis, with exudates in the anterior chamber. She was placed on vigorous antiluetic treatment, including a carefully selected compound of bismuth. On the tenth day of treatment a previously noted elevation of the upper sclera had developed into a small conjunctival ulcer from which escaped a viscous liquid. In the depths of the ulcer the sclera was seen to be also ulcerated. Three other ulcers developed in the same region, and the grayish color of the uveal pigment became visible. Parenchymatous keratitis appeared in the upper part of the cornea. Under atropine, the pupil maintained maximum mydriasis. In spite of the previous record, three doses of the arsenical known as 914 were given at intervals of a few days, in association with the bismuth preparation. The lesions, stationary until this time, began to cicatrize soon after the first arsenical injection, and healing was complete at the end of 16 days of arsenical treatment. The corneal disturbance gradually quieted down.

The second patient was a married woman of 39 years, with several healthy children. For a year she had had persistent irritation of the right eye, with vitreous floaters. This condition culminated in the formation of a flat scleral elevation of purplish color just above the cornea. The Wassermann reaction was negative, the Kahn reaction positive. The condition improved rapidly under arsenic and bismuth. (2 illustrations.)

W. H. Crisp.

Damel, C. S., and Durando, S. A. **Familial corneal dystrophy of Groenouw.** Arch. de Oft. de Buenos Aires, 1942, v. 17, June, p. 348.

Two cases of familial corneal dystrophy of Groenouw, one of the lattice type and the other of the nodular type, are presented. A complete description of the disease is offered, with a review of the literature on the subject. (Illustrations, bibliography.)

Plinio Montalván.

Fish, W. M. **Ocular rosacea and ariboflavinosis.** Amer. Jour. Ophth., 1944, v. 27, April, pp. 354-358. (3 tables, references.)

Malbrán, Jorge. **Keratoplasty after Castroviejo.** Arch. de Oft. de Buenos Aires, 1942, v. 17, July, p. 403.

The author reports the results of his first eight cases of corneal transplant. Castroviejo's technique was followed in every detail and, with the exception of two cases, corneal grafts from cadavers were used systematically. All the transplants were surgically successful and no eye was lost from infection. Three eyes yielded useful vision, one had a clear graft but was found to have an anterior polar cataract, and four developed opacity of the graft. (Illustrations, photographs.)

Plinio Montalván.

Mutch, J. R. **Hereditary corneal dystrophy.** Brit. Jour. Ophth., 1944, v. 28, Feb., pp. 49-86.

An exhaustive review of the literature on hereditary corneal dystrophy is given, together with a summary of 25 different nomenclatures used by writers on the subject. The author offers a classification based on the mode of transmission of the disease, and which should do much to iron out the

confusion arising from the use of a wide variety of descriptive terms.

Two types of hereditary corneal dystrophy (granular and reticular) are inherited by dominant transmission, and a third type (macular) is inherited by recessive transmission. Groenouw, in 1890, described two cases of "nodular cornea." It has since been proved by Bucklers that these two cases were not of the same type, one being granular, occurring in a middle-aged patient who had no complaint of poor vision and whose opacities were limited to the central region of each cornea, and the other, a macular dystrophy, occurring in a young patient who had very poor vision and whose corneal opacities occupied the entire cornea.

Following is a summary of the author's classification. Granular corneal dystrophy begins in the first decade. The opacities are first seen as fine dots, discs, or circles situated below the epithelium in the axial region of the cornea. These dots often form radial lines, hence the confusion between early granular and lattice-like types. Over a number of years, the opacities multiply and coalesce to form clumps. They are mostly superficial but may reach as deep in the parenchyma as Descemet's membrane. Vision in youth is unimpaired. In the second decade, the refraction usually changes but vision can be kept near normal with glasses. In middle age, vision becomes affected but there is no definite progress of the disease, vision in some cases being good even in later life. In old age, the surface of the cornea becomes slightly irregular. Corneal sensitivity in most cases is normal.

Reticular corneal dystrophy also commences in the first decade of life. Until middle age, no corneal abnormality can be seen by macroscopic

examination. The opacities are first seen as transparent nodules like drops of water, surrounded by a fine network of lines which raise the epithelial surface. This surface irregularity causes diminished vision at any early age. Corneal sensation is greatly diminished.

Macular corneal dystrophy commences in the first decade as a fine, diffuse opacity which rapidly occupies the entire cornea. The spots are larger and whiter than in the granular type. In the center of the cornea, the spots are superficial but at the periphery they are deep. The epithelium is irregular and often traversed by pigment lines. Corneal sensitivity is greatly diminished. Vision is affected early and by middle age is reduced to counting fingers.

Illustrations serve to make these differences clear. The common factors of all types and their major differences are set forth in concise tabular form. The author reports a series of investigations undertaken in connection with one of his cases of hereditary corneal dystrophy. (7 illustrations, 1 graph, tables, extensive bibliography.)

Edna M. Reynolds

Stocker, F. W., and Prindle, R. E. A new type of pigment line in the cornea. *Amer. Jour. Ophth.*, 1944, v. 27, April, pp. 341-345. (3 illustrations, 2 in color, references.)

Tarik Oezerengin. A case of interstitial keratitis in association with acquired syphilis. *Göz Klinigi*, 1943, v. 1, Sept., p. 53.

A 40-year-old housewife had acquired syphilis from her first husband. The family history gives no hint of congenital lues. The left eye was normal. The right eye showed typical interstitial keratitis, and a special feature in the form of numerous precipitatelike yel-

lowish-white prominences on the posterior surface of the cornea. There were also posterior synechias. Antiluetic treatment improved the condition to a certain degree, but there were several relapses. Joseph Igersheimer.

Theodore, F. H. Congenital opacities of the cornea. *Arch. of Ophth.*, 1944, v. 31, Feb., pp. 138-143.

In six cases here reported the patients were born with deep opacities of the cornea to which anterior synechiae were attached. Two of the patients were sisters. The opacities were of two types: one of greater density, generally located centrally or nearly so, and the other consisting of a peripheral membrane arising from tissue in the anterior-chamber angle. Microphthalmos was present in three cases and aphakia was noted in one. Visual acuity depended upon the location of the opacity.

Perhaps the most likely explanation of the defect is that it arises as a congenital anomaly due to faulty development of the ingrowing mesoderm that forms the corneal stroma, the endothelium, Descemet's membrane, the anterior layers of the iris, and the trabecula. The cases reported apparently support this explanation. Another theory ascribes the defect to incomplete separation of the lens vesicle from the surface ectoderm. (8 drawings, references.) John C. Long.

## 7

### UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Adler, F. H., and Scarlett, H. Juvenile macular exudative choroiditis. *Arch. of Ophth.*, 1944, v. 31, Feb., pp. 144-147.

In three cases observed in young healthy adults, neither trauma nor an-

tecedent illness seemed related to the condition. All three cases apparently correspond to the diagnostic entity described by Junius. The complaint was of a rather gradual decrease in central vision in one eye only, which progressed for weeks until visual acuity was approximately 6/100, with an absolute central scotoma corresponding in size and shape to the ophthalmoscopically visible macular lesion. The macular lesions were somewhat oval in shape, circumscribed and pigmented, and in places seemed to be covered with connective tissue. A number of small hemorrhages seen around the edges seemed to come from under the pigmented mass. At no time was there any evidence of inflammation. There was no ciliary flush, no deposits on the posterior surface of the cornea, no aqueous flare, no vitreous opacities, and no edema of the retina surrounding the lesions. During the period of observation of from six months to a year there was a gradual improvement in vision, to 6/40 in two cases and to 6/12 in another case.

There is discussion of the differential diagnosis between juvenile macular choroiditis and acute macular choroiditis, tuberculosis of the macula, benign lymphogranuloma, choroidal and subchoroidal hemorrhage in the macula, nevus and malignant melanoma, heredodegeneration and familial degeneration of the macula, and juvenile disciform degeneration. It is thought that juvenile macular choroiditis is probably due to choroidal or subchoroidal hemorrhage, as is likely the case in the senile type of disciform degeneration. (4 fundus drawings, references.) John C. Long.

Bender, M. B. The reaction of the smooth muscle of the denervated iris

in anaphylaxis. *Jour. of Immunology*, 1943, v. 47, Dec., p. 483.

The smooth muscle of the iris contracts during in-vivo anaphylaxis in the guinea pig, rabbit, dog, and cat, and to some extent in the monkey, even if the eyeball has been parasympathetically denervated. If the eyeball is completely denervated the pupil contracts in dog and cat but not in rabbit or monkey. Thus the miosis is not dependent on the nervous system and is probably due, besides histamine, to liberation of a slowly acting substance. Atropine does not block pupillary contraction, so that acetylcholine can not be held responsible for the contraction.

R. Grunfeld.

Damel, C. S., and Meroni, J. C. A. Typical coloboma of lens, iris, and choroid. *Arch. de Oft. de Buenos Aires*, 1942, v. 17, June, p. 357. (See Section 9, Crystalline lens.)

Langworthy, O. R., and Ortega, L. The iris. Innervation of the iris of the albino rabbit as related to its function. Theoretical discussion of abnormalities of the pupils observed in man. *Medicine*, 1943, v. 22, Dec., p. 301.

To explain the pupillary movements, the authors assert, it is not necessary to assume that two antagonistic muscles innervated by two separate autonomic nerve fibers are balanced against each other. The dilator muscle, innervated by the sympathetic, furnishes merely a general tonic background upon which the sphincter acts as long as stimulus is applied to the parasympathetic. The iris is characterized by an enormous vascular supply innervated by the sympathetic. Constriction of the iris vessels (it is here argued) produces a dilatation, and enlargement of the vessels a constriction, of the pupil. If

a dye is injected into the vessels of an iris sector, this sector becomes wider and the pupillary edge becomes flattened, producing an irregularity of the pupil. An irregular pupil can be produced when the blood vessels of one sector receive more fluid than the other sectors. With the raising or lowering of the pressure of the injecting fluid the pupil becomes smaller or larger.

Although the majority of neurologists ascribe the Argyll Robertson pupil to a lesion at the upper end of the midbrain, the authors believe that a peripheral injury in the region of the iris explains the abnormalities of the pupil in a more satisfactory way than a lesion in the central nervous system, as well as explaining more easily a unilateral Argyll Robertson pupil. Lesions producing changes in the iris in syphilis are alleged to be peripheral, in the region of the iris itself, damaging the sympathetic, parasympathetic, and sensory nerve fibers of the pupil.

R. Grunfeld.

Purvis, V. B. Bilateral buphthalmos with congenital anomalies of iris and subluxated lens. *Proc. Royal Soc. Med.*, 1943, v. 36, Oct., p. 627. (See Section 8, Glaucoma and ocular tension.)

Vail, Derrick. Chorioretinitis associated with toxoplasma. *Proc. Royal Soc. Med.*, 1943, v. 36, Oct., p. 629. (See Section 10, Retina and vitreous.)

Wegener, H. P. Senile changes in the choroid and retina. *Amer. Jour. Med. Sciences*, 1944, v. 207, p. 258. (See Section 10, Retina and vitreous.)

## 8

### GLAUCOMA AND OCULAR TENSION

Athens, A. G. Diagnosis of glaucoma. *Minnesota Med.*, 1944, v. 27, Jan., p. 21.



Good therapeutic results in glaucoma are to a considerable extent contingent on its early recognition. The author makes a plea that the general practitioner pay particular attention to the early signs and symptoms of glaucoma in his patients. The initial signs of compensated glaucoma are tabulated, such as fullness of the eyes after a motion picture, or after drinking coffee or other stimulant, decreased dark adaptation, frequent changes of glasses, and halos.

It is recommended that the internist and general practitioner become familiar with some form of tangent screen and the value of visual fields. Particular stress is laid on use of the ophthalmoscope on every patient, in order to be able to recognize glaucomatous changes in the disc.

Owen C. Dickson.

Purvis, V. B. **Bilateral buphthalmos with congenital anomalies of iris and subluxated lens.** *Proc. Royal Soc. Med.*, 1943, v. 36, Oct., p. 627.

A 25-year-old laborer complained of vision having been defective since birth. For the last few weeks he had seen rainbow colors. He had bilateral buphthalmos. Vision of the right eye was reduced to hand movements and in the left was correctable to 5/60 with glasses. The tension was 50 mm. Hg. The discs were grossly cupped. The visual field was reduced to five degrees in the left eye, and in the right eye the visual field could not be charted for lack of fixation. The patient had ectopic pupils displaced down and out and splits in the iris mesoderm. One of the splits was complete, with accompanying tear in the ectoderm, through which a red reflex was obtainable. The splits were not of true polycoria type, for the accessory pupils had no individual sphincters.

R. Grunfeld.

Schoenberg, M. J. **A report on defects found in tonometers examined at the checking station of the National Society for the Prevention of Blindness.** *Amer. Jour. Ophth.*, 1944, v. 27, April, pp. 368-372. (One illustration, one table.)

Smith, V. M. **The problem of prevention of blindness among glaucoma patients.** *Med. Woman's Jour.*, 1943, v. 50, Dec., p. 301. (See Section 18, Hygiene, sociology, education, and history.)

## 9

### CRYSTALLINE LENS

Damel, C. S., and Garbarino, A. **Anterior lenticonus.** *Arch. de Oft. de Buenos Aires*, 1942, v. 17, June, p. 363.

The extreme rarity of anterior lenticonus is stressed and a case reported in which both eyes were affected. The area of the lenticonus presented a very high myopia, while the rest of the lens was practically emmetropic. The authors succeeded in improving the vision substantially by using a plano lens with the myopic correction ground at the center in an area of seven millimeters. (Bibliography.)

Plinio Montalván.

Damel, C. S., and Meroni, J. C. A. **Typical coloboma of lens, iris, and choroid.** *Arch. de Oft. de Buenos Aires*, 1942, v. 17, June, p. 357.

After discussing the possible mechanism of production of lens coloboma, the authors report a case in which the lower portion of the left iris, lens, and choroid presented a typical coloboma, with considerable visual loss in the affected eye. (Bibliography.)

Plinio Montalván.

Georgariou, P., and Wolfe, O. Cho-

lesterinosis lentis. *Amer. Jour. Ophth.*, 1944, v. 27, April, pp. 394-397. (References.)

Kirby, D. B. A system of intracapsular cataract extraction. *Ophth. Iberó Amer.*, 1943, v. 5, no. 2, pp. 95-106 (in English), pp. 106-117 (in Portuguese). The author repeats, for the South American reader, details already published as to indications for and technique of the intracapsular operation. Particular attention is given to the possibility of grasping the lens at its upper margin. This can be done even when iridectomy is not performed, the blades of the capsule forceps being slid beneath the iris in order to take hold of the anterior face of the equatorial region of the lens capsule. In case of resistant, elastic zonular lamella, the author is now prepared definitely to recommend use of his method of stripping the zonular lamella from the upper equator while the forceps holds the lens away from the vitreous, and provided that the vitreous appears to remain in its normal position behind the elevated lens margin. (References.)

W. H. Crisp.

Rolett, D. M. Juvenile cataract in association with dermatosis. *Amer. Jour. Ophth.*, 1944, v. 27, April, pp. 389-393. (2 tables, references.)

## 10

### RETINA AND VITREOUS

Damel, C. S., and Travi, O. C. Unusual evolution of a pre-retinal hemorrhage. *Arch. de Oft de Buenos Aires*, 1942, v. 17, July, p. 421.

The authors report a case in which eight months after the onset of a juxtapapillary choroiditis in the right eye, a large preretinal hemorrhage appeared

in the other eye. At a subsequent visit, a month and a half later, it was observed that the hemorrhage had been transformed into a mass of milky-white fluid. The authors speculate on the changes the blood might have undergone and are inclined to believe that the white fluid may have resulted from fatty degeneration of the white blood-cells with destruction and disappearance of the red corpuscles.

Plinio Montalván.

Denison, W. C. Retinitis proliferans (Eales's disease). *U. S. Naval Med. Bull.*, 1944, v. 42, Jan., p. 180.

A 23-year-old shipfitter complained of blurred vision of the left eye lasting three months, and of sudden blurring of the right eye the past four days. The right vision was 20/50, the left 10/200. The visual fields were greatly contracted. Ophthalmoscopic examination revealed a large organized blood clot in the superior retinal region, with stringy clots extending into the vitreous of the right eye. In the left eye extensive, old hemorrhages were found in the disc and macula, and over a large area in the retina. A thin circular membrane with fine newly-formed blood vessels penetrated into the vitreous.

During the man's stay in the hospital no new hemorrhages were seen in the left eye, but retinal venous hemorrhages involving the disc and macula were seen in the right eye every week for seven weeks. Vision in the right eye diminished to 20/100. No noticeable improvement followed treatment with vitamins, calcium lactate, calcium gluconate, or potassium iodide. The etiology remained undetermined.

R. Grunfeld.

Lijo Pavia, J. Central retinal artery. Induced pulsation. Its analysis by

means of cinematography. Arch. de Oft. de Buenos Aires, 1942, v. 17, July, p. 412.

By means of cinematography of induced arterial pulsation of the fundus an analytic study of arterial pulsations in general can be carried out. The author, who has pioneered in this field, has gradually improved his original technique and uses supersensitive panchromatic motion-picture film, exposing 64 frames per second for periods of about ten seconds. After the film is developed, those portions in which the arterial pulsations are more clearly visible are selected and the necessary prints made in order to lengthen the projection time and thus allow careful study of the two component phases of every pulsation. By this method the author studied the induced arterial pulsation in the fundi of two patients with systemic hypertension and was able to show that the phase of arterial contraction was longer than in normal individuals. He interprets this as a sign of latent angiospasm. (Own bibliography.) Plinio Montalván.

Moreau, Angel. Considerations about hemeralopic retinosis. Arch. de la Soc. Oft. Hisp.-Amer., 1942, v. 1, Nov.-Dec., pp. 521-553.

The author classifies retinosis in two groups: (1) typical pigmentary retinosis of hereditary etiology. (2) acquired retinosis with subjective and objective pathology similar to that of the first group. The histopathologic changes in the retina and choroid are described in accordance with Morax's studies.

In reference to the mechanism of production of pigment, the author offers lengthy theories about points which are still obscure, discussing at length experimental work done by several authors and the role played by heredity,

vitamins, and hormones in the physiopathology of pigment.

In order to understand well the symptomatology of hemeralopic retinosis, the author considers it important to remember the role played by vitamins in the hypophysis in regulating growth, a fact that he has proved experimentally in animals. Experimental work carried out by different authors has led him to believe that pigment is perhaps regulated by a center controlling two hormones; one melanotic, the other adrenalin, which would be antagonistic to the first one.

Experiments performed by the author upon a cat with deficiency of vitamin B<sub>2</sub> lead him to believe that animals lacking lactoflavin cannot produce, or produce a minimum amount of, melanotic hormones. Other experiments carried out on mice convince him that in animals lacking lactoflavin the optohypothalamohypophisopigmentary reflex is absent, demonstrating the role played by lactoflavin in the stimulation of hypophysis through the optic nerve and production of melanotic hormones.

The author attempts to explain the clinical manifestations of hemeralopic retinosis as follows:

(a) In typical hereditary hemeralopic retinosis, heredity and consanguinity have been proved to play a very important role. In this group the author undertakes to prove that primary degeneration does not exist in the pigmentary epithelium but rather in the hypothalamic-hypophysial system. There would be therefore a hereditary disturbance in the production of melanotic hormones and possibly a vitamin deficiency in the hypophysis. The congenital disturbances might be due to congenital syphilis. In this group, when the subjective symptoms of hemeralopia begin to appear without objective

findings, injection of melanotic hormones of hypophyseal extract, together with the administration of vitamin A, may improve the disturbance of dark adaptation.

If the process continues without treatment, the absence of melanotic hormones and the overaction of antagonistic suprarenal hormones create a vicious circle with the typical degenerative changes in the retina and chorioid observed ophthalmoscopically. During this late period of the disease, treatment is useless.

(b) In acquired heremalopic retinosis heredity and consanguinity cannot be demonstrated. In this group the pigmentary changes are secondary to infection or vitamin deficiency. If the condition is observed in the incipient stages treatment will be effective, but treatment will be useless if the condition is observed when a great deal of degenerative change has already taken place. (Bibliography.)

#### Abstracter's comment:

This article does not lend itself very well to abstracting, because the author mixes the histopathologic findings with experimental work and theories regarding the problems he is studying. Also, basing upon theoretical grounds with very little experimental work, he expresses in dogmatic statements conclusions which are not justified by the material contained in the article.

Ramón Castroviejo.

Nuri Fehmi Aybeck. About the significance of tears in operations on retinal detachment and in barrage operations. *Göz Klinigi*, 1943, v. 1, Sept., p. 35.

Three cases of advanced retinal detachment are reported in which, because of vitreous opacities or for other

reasons, a tear in the detached retina could not be found. As a last resort a barrage operation was performed. In the first case the time of observation was eight months; during this time vision remained 1/10. In the second case the vision before operation was hand movements, after the operation 1/50. In the third case vision was improved from counting fingers at three feet to 1/10, but it cannot be said whether this was a final result, as the observation time was too short.

Joseph Igersheimer.

Saenz Canales, Jose. Cyst formation in the vitreous. *Anales de la Soc. Mexicana de Oft.*, etc., 1942, v. 17, July-Aug., pp. 123-139.

The author divides cysts of the vitreous into three groups. The first comprises those which are located in the anterior part of the vitreous and which have developed from remnants of the vascular hyaloid system. The second group is formed of those in the posterior portion of the vitreous, which are also remnants of the hyaloid vascular system, those of mesodermal origin derived from the embryonal slit, and those of retinal origin. The third group deals with free cysts in the vitreous, either congenital or acquired.

A cyst on the nasal border of the papilla, probably arising from the hyaloid system, is described and pictured. (One illustration.)

Eugene M. Blake.

Smith, H. E. Actinic macular retinal pigment degeneration. *U. S. Naval Med. Bull.*, 1944, v. 42, March, p. 675. (See Section 16, Injuries.)

Vail, Derrick. Chorioretinitis associated with toxoplasma. *Proc. Royal Soc. Med.*, 1943, v. 36, Oct., p. 629.

The author reviews the literature on toxoplasma associated with choroiditis. Toxoplasma is a highly organized protozoan parasite consisting of a distinct cytoplasm and nuclear chromatin. It is crescentic, pyriform, oval, or round, and measures 6 to 7 microns in length and 2 to 4 microns in width. It produces diseases in numerous animals; among others the mouse, rat, squirrel, dog, monkey, pigeon, and the common fowl. The parasite can multiply only in living cells and can easily be transferred to animals. The mode of transmission to man is unknown.

The ophthalmoscopic findings in both the infantile and adult cases include: bilateral, multiple, circumscribed, exudative choroiditis with predilection for the macular area. Activity of the lesion is characterized by choroidal hemorrhage usually in the direction of the spread of the lesion, whereas healing is revealed by heavy pigmentation sometimes accompanied by proliferative retinitis and (in one case) by retinal detachment. Microphthalmos and other congenital defects are often found in association.

The diagnosis of congenital cases can be made by the clinical tetrad of symptoms: (1) hydrocephalus or microcephalus, (2) cerebral calcification, (3) choroiditis, (4) disturbances of nervous function. In older children and in adults the diagnosis is based on the toxoplasma-neutralization test.

R. Grunfeld.

Wegener, H. P. **Senile changes in the choroid and retina.** *Amer. Jour. Med. Sciences*, 1944, v. 207, Feb., p. 258.

The author completely reviews the present-day concept of the senile changes occurring in the choroid and retina. These are discussed from both the clinical and pathologic viewpoints.

Wegener believes that in future, if these conditions are to be controlled, we must better appreciate the presenile changes. T. E. Sanders.

## 11

### OPTIC NERVE AND TOXIC AMBLYOPIAS

Barraquer, Tomás. **Ophthalmoscopic aspects of the papilla in some states of hypovitaminosis.** *Arch. de la Soc. Oft. Hisp.-Amer.*, 1942, v. 1, Nov.-Dec., pp. 554-560.

During the recent civil war in Spain, the author saw many cases of hypovitaminosis with the following symptomatology: Hemeralopia and nyctalopia were found to be the initial symptoms of the disease. The lids frequently had areas of hyperkeratosis. In the conjunctiva, several types of conjunctivitis were observed, the most common being phlyctenular keratoconjunctivitis; in these cases the Mantoux test was always positive. The pupil was often found to react sluggishly to light, ptosis was a frequent finding, and some cases showed tropias accompanied by diplopia. Disturbances of the optic nerve were observed in the form of central scotomata with negative ophthalmoscopic pictures, somewhat as in cases of tobacco-alcohol amblyopia. Optic neuritis was also occasionally observed, leading to partial optic atrophy. Anemia was found by the author to have played an important role in the development of these vitamin deficiencies. Treatment was directed to improving the anemic condition, and to administration of vitamins A and B for the improvement of the vitamin deficiency. Ramon Castroviejo.

Folk, M. R. **Optic-nerve atrophy in malignant nasopharyngeal tumors.**

Amer. Jour. Ophth., 1944, v. 27, April, pp. 373-380. (6 illustrations, 1 table, references.)

López Enríquez, M. Amblyopias of the alcoholic nicotinic group due to avitaminosis, or carential (vitamin-deficiency) amblyopias of the alcoholic nicotinic group. Arch. de la Soc. Oft. Hisp.-Amer., 1942, v. 1, Nov.-Dec., pp. 568-577.

During the recent civil war in Spain, the author was able to study 24 cases of amblyopia with the same characteristics as those observed in cases of alcohol-and-tobacco intoxication. The fact that some patients did not smoke or drink led the author to the conclusion that amblyopias similar to those of alcohol-and-tobacco intoxication were caused by vitamin deficiency. Subjectively, diminution of vision and central scotoma were present. Objectively, small whitish dots or arches at or around the macula were observed. Nineteen cases were treated with masculine glandular extracts, strychnine, and vitamin A. Fourteen patients were greatly improved, in two cases the improvement was fair, and three patients became worse.

Ramon Castroviejo.

## 12

### VISUAL TRACTS AND CENTERS.

Enríquez, R. G. Optochiasmatic meningitis. Anales de la Soc. Mexicana de Oft., etc., 1943, v. 8, May-Aug., pp. 17-31.

The ocular symptoms of this intracranial disease are described at length. The most frequent sign is the central scotoma, which was present in 31 percent of the author's cases. A particular symptom is the hemianopsic central scotoma of the temporal portion, due

to involvement of the macular fibers of the crossed bundle. This is similar to the cases described by the neurologists as due to plaques of sclerosis, causing compression. In the case mentioned by the author, the scotoma was annular, a fact difficult to explain unless one assumes involvement of the arenate fibers between the macular and peripheral bundles. Eugene M. Blake.

Poyales, Ureña. Contribution to the study of central scotoma due to avitaminosis, or contribution to the study of carential (vitamin deficiency) central scotoma. Arch. de la Soc. Oft. Hisp.-Amer., 1942, v. 1, Nov.-Dec., pp. 561-567.

Using Lloyd's stereocampimeter to record the visual fields, the author has been able to study 128 cases of avitaminosis. In 27 percent the fields showed changes in only one eye. In the remaining 73 percent the field changes were bilateral. Visual field changes varied from relative scotoma for color to absolute scotoma including the area corresponding to the macula. In the bilateral cases the field changes were sometimes symmetrical, in other cases similar but not symmetrical, and in a third group asymmetrical.

The treatment employed was administration of 500 mg. daily of nicotinic acid. With this treatment 41 percent were cured, 21 percent improved, 14 percent remained unchanged, and 24 percent became worse in spite of the treatment. Ramon Castroviejo.

Reeder, J. E., Jr. The psychogenic color field. Amer. Jour. Ophth., 1944, v. 27, April, pp. 358-361. (4 fields, 1 table.)

Yaskin, J. D., Riggs, M. E., and Torney, A. S. Bilateral blindness due to lesions in both occipital lobes. New York.

State Jour. Med., 1943, v. 43, Sept. 1, p. 1619.

Bilateral blindness due to lesions in both occipital lobes may be caused by subcortical degenerative processes, trauma, tumors, toxic encephalopathy, and vascular lesions. Vascular lesions produce bilateral blindness through occlusion of both posterior cerebral arteries, or by complete occlusion of the basilar artery. In these cases some central (macular) vision may be retained if the occipital poles have an additional blood supply from the branches of the middle or anterior cerebral arteries. In some cases the visual area is affected primarily by changes in the small terminal vessels. Of the six reported cases, four were caused by vascular lesions and were verified by autopsy. One case was due to metastatic carcinoma of the stomach and another was due to a meningioma. Bilateral blindness, when not due to discernible changes in the media, choroid, retina, or optic nerve, or, in early stages, to chiasmal field changes, must be considered as being due to lateral lesions in the geniculocalcarine pathways, especially the occipital lobes, or to psychic causes. The insidious onset of blindness and the masking by associated symptoms make an early diagnosis difficult.

Theodore M. Shapira.

### 13

#### EYEBALL AND ORBIT

Blonder, E. J. Orbital cellulitis complicating a maxillary sinusitis. *Annals of Otol., Rhin., and Laryng.*, 1943, v. 52, June, p. 524.

A case of orbital cellulitis secondary to maxillary sinusitis, with recovery following surgical drainage of the antrum, is reported. Robert N. Shaffer.

Constans, G. M. Unusual eye findings in identical twins. *Amer. Jour. Ophth.*, 1944, v. 27, April, pp. 401-403.

### 14

#### EYELIDS AND LACRIMAL APPARATUS

Lee, O. S. Keratitis occurring with molluscum contagiosum. *Arch. of Ophth.*, 1944, v. 31, Jan., pp. 64-67.

The umbilicated epithelial nodules of molluscum contagiosum are usually circular, average 2 mm. in diameter, and are covered with normal epithelium. From the center of the umbilication a cheesy mass consisting of ovoid cells can be expressed. These bodies are composed of swollen and vacuolated epithelial cells. A virus origin has been established, and the disease is transmissible from person to person by material passed through Chamberland filters.

Molluscum contagiosum rarely appears on the eyelids. Its appearance there is similar to that elsewhere on the skin. Nodules along the margins of the lids may produce follicular conjunctivitis.

After a review of the literature the author reports the case of a 24-year-old man who, when first seen, complained of redness, slight itching, pain, and crusting of the lid margins. He was treated for acute catarrhal conjunctivitis. He returned a few days later stating that he had improved under the medication, but that for the past three days there had been profuse lacrimation, severe photophobia, blepharospasm, and the sensation of a foreign body in the eye. The eye changes included edema, follicles in the conjunctiva of the lower eyelid and cul-de-sac, a faint circumcorneal flush, and (as seen with the biomicroscope) small subepithelial and intraepithelial corneal



infiltrates. A small, round, yellow-tinged nodule was seen on the margin of the lower lid. Nothing could be expressed from it by squeezing. Culture and smears were again negative, but microscopic examination of the excised nodule showed the typical histologic appearance of molluscum contagiosum. The patient's ocular condition improved within 24 hours after removal of the nodule.

The mechanism of production of conjunctivitis and keratitis in cases of mol-

luscum contagiosum is not yet clearly understood. Thygeson has expressed the belief that the desquamating material from the molluscum nodule contains a toxic substance which produces the inflammation. All nodules on the margins of the lids should be viewed with suspicion when they are associated with inflammation of the conjunctiva and cornea. Such nodules should be excised for microscopic study whenever possible. (2 illustrations, references.)

R. W. Danielson.

## NEWS ITEMS

Edited by DR. DONALD J. LYLE  
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News items should reach the editor by the twelfth of the month

### DEATHS

Dr. William W. Gilfillan, New York, New York, died February 10, 1944, aged 75 years.

Dr. Charles H. Hoffhine, Columbus, Ohio, died February 8, 1944, aged 60 years.

Dr. John F. Johnson, Chicago, Illinois, died February 19, 1944, aged 72 years.

Dr. Herbert L. Lake, Lyons, New York, died January 30, 1944, aged 83 years.

Dr. Charles E. Robb, Rock Island, Illinois, died February 27, 1944, aged 62 years.

Dr. Franklin T. Scanlon, Morgantown, West Virginia, died February 25, 1944, aged 65 years.

Dr. Samuel A. Scruggs, Jr., Americus, Georgia, died February 26, 1944, aged 54 years.

Dr. Bert A. Smith, Auburn, Nebraska, died January 11, 1944, aged 55 years.

Dr. John W. Stevenson, Hoquiam, Washington, died January 20, 1944, aged 79 years.

Dr. Charles M. Stiles, Philadelphia, Pennsylvania, died January 27, 1944, aged 77 years.

Dr. J. Boyd Swonger, Beaumont, Texas, died January 26, 1944, aged 75 years.

Dr. Willis Walley, Jackson, Mississippi, died April 9, 1944, aged 66 years.

### SOCIETIES

At the meeting of the College of Physicians of Philadelphia, Section on Ophthalmology, held on January 20, 1944, Dr. Joseph Igersheimer presented a paper on "Intraocular pressure and transudation across retinal vessels."

The thirtieth meeting of the Reading Eye, Ear, Nose, and Throat Society was held on Wednesday, February 16, 1944, at Valley Forge General Hospital. The program, presented by Lt. Col. James N. Greear, Jr., Chief of the EENT Section, consisted of the following subjects: "Plastic work on war injuries," "A new method of bronchography," "Rehabilitation of blind members of the Armed Forces," "Retinal detachment," and "Injuries to the occipital lobes."

The annual congress of the Ophthalmological Society of the United Kingdom was held at the Royal Society of Medicine, London, on March 31 and April 1, 1944. The presidential address was entitled "The nerve fiber bundle defect." Papers presented during the two-day session were: (1) "Concentric restriction of vision from unilateral cerebral lesion"; (2) "Sphenoidal mucocoele as a cause of the ophthalmoplegic migraine syndrome"; (3) "The use of plastic material for scleral wounds"; (4) "The elastic tissue within the eye"; (5) "Hyaline bodies in the intraocular fluids and tissues"; (6) "A sequel to the case of spontaneous cure of retinal glioma"; (7) "Fractures of the orbit"; (8) "Ophthalmic experiences in the East"; and (9) "Radon seeds in the treatment of retinoblastoma."

The thirty-first meeting of the Reading Eye, Ear, Nose, and Throat Society, Reading, Pennsylvania, was held on March 15, 1944. Dr. William A. Lell of Philadelphia gave a lecture on "The larynx" accompanied by lantern slides and motion pictures.

At the April meeting of the Cleveland Ophthalmological Club, Dr. J. C. Gerneroy of Detroit, Michigan, was the guest speaker. The subject of his presentation was "External diseases of the eye," illustrated by some excellent colored slides of the various external diseases. The report of an interesting case of "Melanosarcoma of the ciliary body" was given by Drs. Paul Motto and James Greetham.

At the meeting of the Washington, D.C., Ophthalmological Society held April 24, 1944, the following program was given: "Relationship of German measles to congenital ocular diseases" by Dr. Benjamin Rones; a panel discussion on "Simple glaucoma" by Drs. Edward J. Cummings, Louis S. Greene, and John W. Burke, who spoke on "Early diagnosis," "Cases with nocturnal pain," and "Choice of operation," respectively. Mrs. Helenor Campbell Wilder held an exhibit on "Granulomas on the eye and adnexa" from the Army Medical Museum. Other contributions were made by Dr. Ronald Cox on "A case of nodular episcleritis," Dr. John R. Lloyd on "Old retinal detachment with visible peripheral tear," Dr. C. R. Naples on "A case of circinate retinitis," and Dr. Richard Wilkinson on "Macular lesion."

The Illinois State Medical Society held its one-hundred-and-fourth annual session in Chicago, May 16th to 18th. Dr. Harold Gifford, Jr., of Omaha, spoke on "The more common lacrimal problems."

At the ninety-first annual meeting of the Medical Society of the State of North Carolina, held May 1st to 3d, Dr. James W. White discussed "Ocular muscle paralyses—their diagnosis and treatment."

Among the speakers at the twenty-fifth annual meeting of the Virginia Society of Ophthalmology and Oto-Laryngology, April 29th, was Dr. John H. Dunnington, New York, who spoke on "Complications of cataract extraction."

The West Virginia State Medical Association held its seventy-seventh annual meeting on May 15th and 16th. Dr. Francis H. Adler, one of the participants in the program, pre-

sented a paper on "The role of exophthalmos in differential diagnosis and treatment of Graves's disease."

Dr. Albert D. Ruedemann of Cleveland was among the speakers at the eighty-fifth annual session of the Kansas Medical Society, May 10th and 11th. The title of his paper was "Headaches and head pains of interest to the general man."

At the one-hundred-and-fifty-second annual meeting of the Connecticut State Medical Society Dr. Maynard C. Wheeler spoke on "The measurement and treatment of strabismus in children."

The Pan-American Congress, scheduled to meet in Montevideo in November, 1944, will meet instead in November, 1945.

The next annual meeting of the Southern Medical Association will be held in Saint Louis, Missouri, November 13-16, 1944.

At the meeting of the Reading Eye, Ear, Nose, and Throat Society, Reading, Pennsylvania, held on April 19th, Dr. George P. Guibor of Chicago spoke on the following subjects: "Practical points in the diagnosis of motor disturbances," "The use of prisms in the diagnosis and treatment of motor disturbances," "The use of atropine in the diagnosis of motor disturbances," and "Indication for surgery after nonsurgical treatment." In addition Dr. Guibor conducted a squint clinic. Mr. Austin B. Belgard of Chicago read a paper on "Optical centers and their relationship to fusional amplitude."

#### PERSONALS

Dr. Wendell L. Hughes and Dr. Willis S. Knighton have been appointed associate clinical professors of ophthalmology on the staff of the Columbia University College of Physicians and Surgeons.

Dr. William Thornwall Davis has been chosen as an honorary consultant to the Army Medical Library, Washington, D.C., and received a certificate upon acceptance of this honor.

## PTOSIS—POSTTRAUMATIC AND HYSTERICAL\*

EDMUND B. SPAETH, M.D.

*Philadelphia 3.*

The diagnosis of hysteria as the underlying etiologic factor in a frank post-traumatic ophthalmic condition is somewhat serious. There is no doubt that legal decisions and compensation for the injury might be a most significant factor, fairly or unfairly granted. This cause (trauma) would also be relevant in cases of malingering, whether deliberate or psychopathic.

The faulty diagnosis of hysteria is as serious an error as would be the opposite; that is, to consider a true hysterical situation organic. The latter error would be unusual, the former error is the more likely; either could result in maltreatment, and be the cause of failure in recovery.

The gross inconsistencies which present themselves in cases of hysterical diplegia of the lower extremities, for instance, are rather easily uncovered, compared to the minute detailed inconsistencies possible in an oculomotor syndrome, also hysterical. It would seem that the diagnosis in the latter of the two conditions mentioned is made by exclusion rather than by conclusion, as would be the more important in the former condition.

Hysterical paralyses may be either flaccid in type, even to the wasting of the involved muscles (although such instances can be distinguished from true or-

ganic degeneration by the absence of the electrical reaction degeneration), or they may be accompanied by pseudocontractures. In either case it seems to be the result of an active inhibition, a demonstration of the patient's conviction that it is impossible for him to perform certain movements. It would seem that by the autosuggestion, which is the basis of hysteria, the patient dissociates the affected muscles (conjoined function of associated muscles) from his consciousness.

In hysterical ptosis the patient actually, as well as psychologically, is withdrawing from the world of reality, for if the lids are manually elevated he may substitute hysterical amblyopia (retinal anesthesia) for the ptosis.

Hysterical ptosis is not an uncommon finding. Roemer has described both types—a flaccid paralysis and the pseudoptosis of orbicularis contracture. Wilbrand-Saenger believes that hysterical ptosis is usually an orbicularis contracture. Purves-Stewart also has described both types—the flaccid and the contracture forms. Other references in the literature are similar as to their conclusions.

Hysterical squint or strabismus is probably caused in the same manner. In this condition, however, the consensus of opinion seems to be that it is due to a pseudocontracture. For instance, a convergent squint would be a spasm of the adductors rather than a paralysis of the abductors; conversely, a divergent hysterical squint would be the result of spasm

\*From the Graduate Hospital, the Graduate School of Medicine, the University of Pennsylvania. Presented before the Section of Ophthalmology, the Philadelphia College of Physicians, April 15, 1943.

of the abductors rather than a paralysis of the adductors.

It is a neuropsychiatric truism that hysterical palsy is never an involvement of a single muscle. Hysteria, hence, manifested as a paralysis, will affect any part of the body, but unlike an organic lesion never confines itself to a single isolated muscle or to a group of muscles innervated by a single nerve or spinal segment. It has as its primary purpose the suppression of a sense, the abolition of a function, the negation of a positive act or chain of habits. This is beautifully seen in the complexities of the ocular rotations and their relationship to hysteria.

Adduction as a binocular function is a simultaneous innervation of six muscles that have bilateral, homolateral, and contralateral nuclear origins as a source for their nerve supply. Abduction as a function, binocularly also, is the result of simultaneous innervation of six muscles, but this implies even more the nerve-muscle integrity of three different cranial nerves. The perfection of binocularity is in the final analysis even more—it is a conditioned cerebral reflex, a cerebral function.

Abduction and adduction in terms of a binocular function—that is, convergence and divergence—can be, and are not infrequently, lost. When these are lost they are the result of nuclear pathology (or even of supranuclear cortex changes) and have clean-cut characteristic ophthalmic symptoms. The same is true of a paralysis of left or right gaze, or even of vertical associated movements. Here, also, the ophthalmic syndromes of these conditions are rather cleanly cut with classical courses. These are seldom, if ever, the result of vague etiology, and their basic and accompanying characteristic findings are consistent. This must be so, considering their central-nervous-system control, normal as well as pathologic.

Ptosis as a syndrome of paralysis presupposes a partial third-nerve palsy, a cervical sympathetic paralysis, or both simultaneously involved. The degree of ptosis present, with certain other significant ocular signs and symptoms, is sufficient to decide which underlying nerve defect is at fault.

An acquired third-nerve levator palsy, no matter of how long standing, is not followed by a contracture of the antagonist; that is, in this instance the upper arc of the fibers of the orbicularis palpebrarum. Similarly, the lesser degree of ptosis, from a cervical sympathetic paralysis, would be spared such contractures. The occipitofrontalis in a true ptosis is raised, the eyebrow arched upward. In hysterical ptosis, however, the opposite occipitofrontalis, on the normal side, may be raised, or in the case of a contracture ptosis the eyebrow may be actually lowered on the apparent paralytic side. The orbitopalpebral fold is seldom ironed out as is seen in true ptosis, whether congenital or acquired. In true congenital ptosis, the upper lid seldom, if ever, follows the eyeball fully and normally downward, in strong downward rotation, as does the normal lid. The lower lid actually moves faster and with a greater disproportionate excursion; and this results in a widened palpebral fissure with strong downward gaze. In hysterical ptosis, the excursion of the upper lid, with downward rotations, is greater than normal. This can be seen in figure 1 as illustrated. Manual elevation of the ptotic lid in hysterical ptosis quite frequently results in resistance on the part of the patient. When the upper lid is lifted and then released the pseudocontracture or actual contraction of the orbicularis, in spasm, closes the lid with a crash. Careful examination may show, at this time, a simultaneous fibrillar contraction of the orbicularis fibers as they lie in the lower lid.



Fig. 1 (Spaeth). A, Unposed photograph in repose. B, Photograph taken when patient was instructed to look directly at the camera. Exposures for these photographs were all flash exposures. C, Illustrates the lack of response on the part of the patient, for she is being instructed to follow a moving finger.

The case to be presented is that of a girl aged 19 years, who, following a minor injury to the back of her head in an automobile accident, developed a bilateral ptosis, a suggestion of right conjugate deviation in repose, and a definite limitation of external, superior, and internal rotations—all in the left eye. The ptosis, however, was greater on the right than on the left. If this condition was truly organic it would mean a paralysis (paresis) of the left external rectus, the left superior and inferior recti, and with this a bilateral levator paralysis (or pare-

sis) (superior branch of both third nerves) combined with an involvement of left associated concomitant gaze. Figure 1A and figure 2A illustrate her appearance when gazing left and the apparent right conjugate deviation. Figure 1A could show her attempt to escape diplopia from a paralytic external rectus on the left. If so, then the condition depicted in figure 2A would be quite impossible. Fixation, as here with a paralytic left eye, should result in a strong overconvergence in the right, as a secondary deviation; for in true fixation with the normal right eye



Fig. 2 (Spaeth). A, Manual elevation of the ptotic lids without instructions to the patient. B, The same thing. Patient instructed to look to the left. Illustrates the limitation of upper rotation in the left eye with a suggestion of overaction of the right inferior oblique. C, The patient in repose, both lids normal, eyes to the front while wearing but a single crutch to lift the right lid only.

the left would need to come to rest in a primary convergent squint, less in amount but manifest.

It was impossible for the case to be one of a pontine type of conjugate deviation, traumatic in nature, because of the irregularity and the inequality of the left lateral rotations. A pontine type of conjugate deviation, while minimal in amount, as compared to the cerebral type of deviation, is seldom if ever a sign of brain-stem irritation; is minimal in degree; is a permanent condition never compensated for; the oculomotor excursions (or absence of these) are symmetrical; and it is almost certainly accompanied by asymmetrical paralyses of associated muscles in consequence of the extension of a brain-stem lesion upward and supranuclear and downward to other cranial-nerve nuclei. The innervation of the levators is homolateral in each eye without crossing of the fibers; that is, without contralateral nuclear supply. This case would thus need bilateral organic lesions.

A true sixth-nerve palsy would be accompanied by diplopia and a secondary deviation. Neither of these was present, though repeatedly a transient diplopia could be picked up in the left lateral field.

A paralysis of the sixth nerve on the left with bilateral ptosis could not be organic in origin without manifesting other symptoms of brain-stem pathology. The classical internuclear syndrome of trauma was lacking entirely. Figure 2B shows the normal excursions with internal rotation of the right eye and the limitation of upper rotation as seen in the left eye. The homolateral brain-stem origin of the sixth nerve, the levator and the superior rectus, all on the left, is consistent with an organic situation, as an internuclear syndrome, but becomes immediately impossible when there is added thereto ptosis of

the upper lid on the right with right-eye divergence; that is, with external rotation of the right eye in repose. The diagnosis of an intranuclear syndrome would necessarily presuppose that the ptosis present was purely right; hence, right-sided in the brain stem with an accompanying right internal-rectus incomplete paralysis, from involvement of the right-sided half of the fibers. This, however, did not answer the paresis of the superior rectus on the left, and the partial ptosis on the left, the innervations of which arise from the left brain stem. The apparent impairment of the external rectus on the left (see fig. 2B) was consistent with a possible left-sided pathologic change, and as such presupposes bilateral pathologic lesions around the aqueduct and in the internuclear connections between the third-nerve nuclei bilaterally and the levator and internal rectus on the right; and the levator with the superior rectus and the external rectus on the left. While these were truly bizarre, they still were possible. Unfortunately, this anatomic diagnosis broke down wholly in considering the observations made when the patient was recovering from an anesthetic (which will be discussed later) and the complete disappearance of all disturbances of extraocular motility when a single crutch lens was placed to lift the right lid (also to be discussed later).

Following the automobile accident, litigation was started by the patient in the case, but as no insurance was carried by the owner of the automobile the case was dropped from the courts. Three months after the onset of the condition the patient was admitted to the hospital for careful studies. The neurologic studies throughout failed to show any pathologic changes in the reflexes, in sensation, in posture, or in gait. No cerebellar sign was present. The Bárány showed a normal left hori-

zontal nystagmus, *although this could be the response of the entire adductor-abductor group, and not of a single muscle.* The results of spinal-fluid and X-ray studies were negative. The limitation of upward rotation on the left, in the field of the superior rectus, did, however, cause in left lateral rotation, a slight overaction of the right inferior oblique. A vague history was obtained from the mother that since early childhood the patient has had

Psychotherapy was attempted but was without definite results. The patient was given a crutch glass with one crutch only on the right upper lid. This resulted in the normal binocular opening of both palpebral fissures and there was in the next few weeks, a marked return in the degree of left external rotation.

When the crutch glasses were removed the patient again developed, immediately, the bilateral ptosis. It was suggested that



Fig. 3 (Spaeth). A and B, Patient after sudden recovery from all ptosis as well as from all other oculomotor disturbances.

for periods some type of oculomotor disturbance in one of her eyes. The patient herself denied this and it cannot be confirmed otherwise. If this is true, and it might well be so, it seems that the patient was utilizing a preëxisting oculomotor condition, though perhaps minimal in amount, as the basis for her conversion neurosis. It was, however, the only sign, even though so distant as to be almost impossible, of the only disease condition not wholly eliminated; that is, multiple sclerosis.

A facial-nerve block done on the right side gave quite inconclusive indications. The patient was then given a general venethene anesthetic. When recovering from the anesthetic she became quite voluble; both lids opened widely and normally and her ocular rotations were full in all directions, except for some slight limitation, in the horizontal, of external rotation on the left as compared to the normal extent of the rotations in the right eye to the right.

the crutch be taken from the right lens and placed on the left to see if the elevation of that lid resulted in a simultaneous elevation of the right. This was not done, however, for when the right lid was lifted manually, the left opened spontaneously and simultaneously. When the left upper lid alone was lifted the right lid continued ptotic.

Six months after her presentation before the Neurological Conference at The Graduate Hospital, and while still wearing her crutch glasses, the patient was happily married. She also continued employment in an arsenal, working in parachute packing. Her relationship with her mother-in-law became very satisfactory shortly after her husband was called into the armed service. One morning, after an unusually pleasant evening spent with her mother-in-law, the patient awakened in the morning, and to quote her, "she discovered that she could lift her lids normally and without the assistance of the crutch glasses." The patient reported to



the eye clinic on the same afternoon, and it was found that not only had the ptosis recovered completely, but also all of her other aforementioned vague and rather indefinite oculomotor limitations had disappeared (fig. 3A, B). The crutch was removed from the frame of the patient's glasses and she has continued since without any further complaint.

The points of interest, and hence of clinical importance are (1) the vague history of some preëxisting oculomotor disturbance; (2) the traumatic relationship etiologically; (3) the associated oculomotor disturbances without loss of vision, asymmetric in character and without constant characteristic diplopia or secondary deviation; (4) spontaneous correction of the bilateral ptosis when only one lid was lifted manually; (5) the absence of any other neurologic signs which might suggest pathologic changes in the brainstem; (6) the failure to obtain any improvement in the condition by suggestion therapy; (7) the sudden and dramatic recovery is almost certainly diagnostic of the underlying functional pathology; and (8) the case illustrates rather well an indefinite asymmetric situation probable when hysterical ptosis is considered as a pathologic entity.

## CONCLUSION

An unusual oculomotor situation is presented as a posttraumatic manifestation. The diagnosis was considered to be hysteria, upon the basis of inconsistencies in the symptomatology and with neuro-anatomic impossibilities. Time and subsequent findings proved this etiologic diagnosis. Up to the time of abrupt recovery the gross extraocular-muscle incongruities could not be answered upon an organic basis.

The condition as seen in figure 2C remained unchanged for eight months. There was no incapacity whatsoever as long as the patient wore her crutch lens. Without it, within a very few minutes, the patient reverted to the condition shown in figure 1A, B, C. The length of time intervening since the original presentation of this case and up to the present was an interval deliberately selected in the hope that differences in the situation might appear and permit a certain etiologic diagnosis. This interval was somewhat against the diagnosis of a functional state but not conclusively so. As stated, the patient now remains fully recovered.

*1930 Chestnut Street.*

# THE EXOPHTHALMOS OF HYPERTHYROIDISM

A DIFFERENTIATION IN THE MECHANISM, PATHOLOGY, SYMPTOMATOLOGY, AND  
TREATMENT OF TWO VARIETIES

## Part II

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### B. THYROTROPHIC EXOPHTHALMOS

The association of hyperthyroidism with morbid conditions of the pituitary gland and the demonstration that an-exophthalmic variety of hyperthyroidism follows the injection of an anterior pituitary extract has led to the opinion held today by not a few that exophthalmic goiter is the outcome of thyrotrophic activity. Criticism of this view is justifiable for several reasons of which two only will be mentioned; namely, that the presence of an excess of thyrotrophic hormone, constantly discernible in those conditions associated with an increase, has not been found in thyrotoxicosis, and, secondly, that the experimental type of proptosis resulting from injections of pituitary extract differs markedly in its main features from that of thyrotoxicosis. Thyrotrophic hyperthyroidism, however, occurs in more than one form in man, and of these one is accompanied by a type of exophthalmos as nearly identical as can be with the experimental variety alluded to above. The close similarity of these two types indicates strongly the probable pathogenesis concerned in the development of the human variety; hence the finding of an increased quantity of thyrotrophic hormone in the serum of patients with thyrotrophic exophthalmos forms a not unexpected item of corroboration.

Of confirmatory importance, too, may be added the difference in effect on the proptosis obtained by an injection containing thyrotrophic hormone into patients with exophthalmic goiter and thyrotrophic exophthalmos. In the former, the

proptosis is unaltered; but in the case of the latter, a severe exacerbation may ensue. An illuminating account of such a mishap has been given by Stallard (1936). A middle-aged man, with features conforming to the thyrotrophic type of exophthalmos, was given a single injection containing 600 units of thyrotrophic hormone. Within three weeks a mild degree of proptosis was precipitated into the severe malignant variety, leading to the loss of one eye and marked damage to the other after a further short space of three weeks. Such a rapid sequence to a single injection of a thyrotrophic extract affords strong presumption that the measure reacted as part of the active pathologic process; hence it is interesting to learn that biopsy of an affected eye muscle disclosed the morbid changes characteristic of the thyrotrophic variety of exophthalmos.

*General features of the disease.* Before proceeding to a detailed description of the exophthalmos, a few remarks on some general aspects of the condition may be of interest. Thyrotrophic exophthalmos is not common but, including the more frequent mild varieties, is seen probably at least two or three times a year at most general or ophthalmic hospitals in this country. It is three or four times as common in males as in women and is most frequent about the time of the menopause, the average age among 22 males and 6 females being 54 and 47 years, respectively, a feature which illustrates rather well the tendency of the climacteric to arrive nearly a decade later in men.

The disease presents two main characteristics, hyperthyroidism and exophthalmos. Both of these features may be well marked or only slightly developed, or either one predominant. As a rule, the primary cases show a preponderance of one or other factor so that many patients



Fig. 14 (Mulvany). Thyrotrophic exophthalmos. Note clinical resemblance to cavernous-sinus thrombosis. Autopsy disclosed a tumor of the pituitary body (Würdemann and Becker, 1905).

operated upon for hyperthyroidism show only a slight exophthalmos, or, conversely, the patient may attend the ophthalmic department with little evidence of hyperthyroidism. An average rise of basal metabolism would fall between +30 and +40 percent, but the writer has encountered instances varying from +4 to +75 percent. With a low grade of hyperthyroidism there may be doubt as to diagnosis, and in certain instances with a pronounced proptosis and doubtful hyperthyroidism, orbital neoplasm or an ophthalmoplegia of obscure character may be diagnosed. The majority of cases labeled exophthalmic ophthalmoplegia are instances of this syndrome. Occasionally the severe degree of exophthalmos with its accompanying edema and evidence of

retrobulbar congestion has created the impression of a thrombosis of the cavernous sinus (fig. 14). In 1938 two such cases were seen, one having been designated idiopathic aseptic because the patient made a partial recovery and the other chronic because the condition remained more or less stationary for two months until death occurred from pulmonary embolism. Many instances, however, are of a mild character, and the patients in these circumstances have attended for a long period the various departments of a hospital without receiving a definite diagnosis.

One other point calling for reference is the tendency to spontaneous arrest and sometimes remission of the disease. Many of the early or mild cases never progress beyond the first stage, and the writer has under his care two cases in which the condition has been stationary for 6 and 10 years, respectively, the B.M.R. in the latter having ranged from +15 to +40 percent during this period without general ill effect. In the more vigorous type of case, a spontaneous halt may also occur but seldom before some form of treatment, usually a thyroidectomy, has been carried out. The operation invariably removes the hyperthyroidism, but in a good proportion of cases the proptosis is accentuated, owing to the stimulus to the pituitary gland provided by the removal



Fig. 15 (Mulvany). Thyrotrophic exophthalmos before and after thyroidectomy (Anderson, 1932).

of the thyroid gland (fig. 15). Grave complications may follow, requiring some

form of orbital decompression, but even in this severe type of case, as mentioned by Naffziger, the tendency to steady improvement over a period of years still remains.

*Observations on possible pathogenesis.* Earlier it has been suggested that the essential components of the pathogenesis comprise the coincident presence of increased quantities of the thyrotrophic hormone and certain sterones, in particular testosterone.

The actual mechanism accountable for the pathologic changes in the eye muscles is obscure, but it is possible that the specific effect on striped muscle of the male hormone and maybe of other sterones is altered by the thyrotrophin. The characteristic action of these substances on muscle tissue is well known. It may be recognized in the muscular hypertrophy accompanying virilism or resulting from testosterone administration. Generalized in effect, there is often a disposition to excessive activity at certain sites. A good example of this local response is seen in the bulk of the temporal muscle of the guinea pig, normally large enough to service as a sex-distinguishing feature, which is markedly reduced after castration to reappear on androgen replacement. Another local effect of possible importance is an alteration in water content. This is best illustrated by the swelling of the capon's comb, mainly due to increased water content, in response to androgen. The phenomenon is on a par with the local edema of the vulva produced in monkeys by estrin which may spread to the muscles of the gluteal region and back; although it is doubtful whether the estrogens are in any way concerned in the production of thyrotrophic exophthalmos.

The examples are given to show that it is biologically possible for certain hormones to exert a marked effect both on the metabolism and water content of striped muscle, the exact significance of which will be better appreciated in connection with an analysis of the pathologic changes in the ocular muscles. In men the source of the sterone is obvious but in women, particularly after the menopause, its origin is less certain. It is possible that

in the postmenopausal era the adrenal cortex produces an effective substitute, and in earlier epochs the position of progesterone has to be determined. The prospect suggests a fruitful avenue for exploration.

#### I. MECHANISM OF THYROTROPHIC EXOPHTHALMOS

In this condition the mechanism is straightforward and simple, consisting of an increase of retrobulbar pressure as a result of which the eye is pushed out of the orbit. The rise in tension is brought about by a peculiar type of pathologic change in the eye muscles leading to great enlargement, which, taking place within the bony confines of the orbit, necessarily causes protrusion of the globe. The process is progressive but may be very slow after the initial push, little further proptosis taking place over a period of several years. Other cases less deliberate in development are more severe, owing to the orbital contents having to accommodate themselves more rapidly to the increasing muscular bulk. Part of the enlarging mass expands within the extraocular cone at the expense of the fat, which is often reduced in amount and may be absent. The main effect, however, is felt on the rear of the globe and periorbital septum, leading to proptosis and fullness of the lids. Later palpebral and conjunctival edema ensues due to compression of the venous arcades at the base of the lids, where the vessels undergo a hairpin bend (fig. 16). Following this the lids become more tightly apposed to the corneal surface and their increasing tension resists the forward movement of the eye. The intraorbital pressure rises rapidly, causing the establishment of a vicious circle so obstinate that it is seldom resolved by anything less radical than a full orbital decompression. More particularly is this

so when the main venous return has been obstructed, for generalized edema of the orbital contents may then supervene. However, this complication is not so common as might be expected.

Hyperthyroidism plays no part in the mechanism. This is shown as much by the number of cases that progress or appear to develop after a thyroidectomy as by the experimental finding that the proptosis is

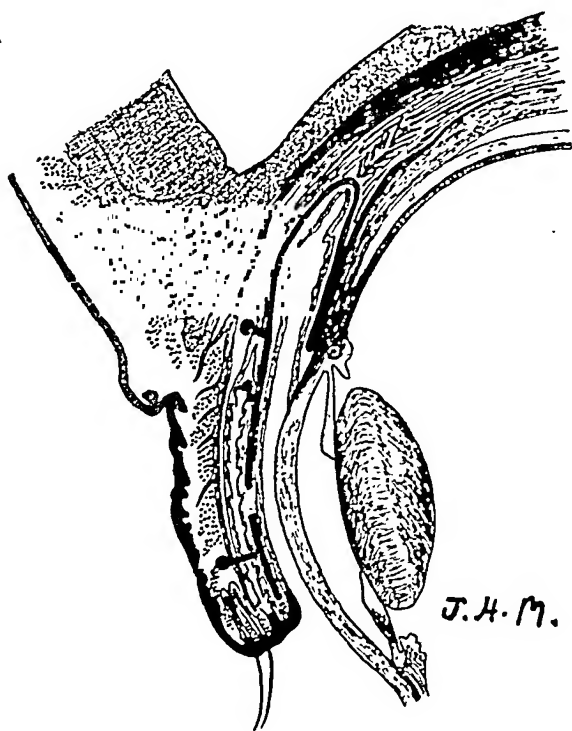


Fig. 16 (Mulvany). Upper eyelid. Schematic representation showing acute bend of palpebral vessels in region of upper fornix (after Duke-Elder, 1938).

produced more rapidly, more prominently, and with greater ease in animals previously thyroidectomized. Conversely, it has been shown that the administration of thyroid tends to reduce the efficacy of the thyrotrophic injection. It is evident that the postthyroidectomy facilitation is connected with the stimulus to hypophyseal activity induced by the operation.

Further, there is no evidence, either experimental or clinical, to implicate the

sympathetic nervous system in the production of thyrotrophic exophthalmos. In guinea pigs, Smelser (1937) has shown that resection of the cervical sympathetic ganglion does not prevent nor alter in any way the proptosis induced by injections of anterior pituitary extract. In man, also, the absence of features pointing to sympathetic involvement is noteworthy, and there is on record a description of the proptosis developing in a case of paralysis of the cervical sympathetic (Brain, 1939). Although considered to be a case of Graves's disease, the related clinical effects indicate the thyrotrophic nature of the condition. Items such as the onset after the gonadothyrotrophic stimulus of pregnancy, the story of lacrimation, the glassy appearance of the conjunctiva, the puffiness or fullness of the lids, the retraction of the upper lid in the absence of sympathetic spasm, the small enlargement of the thyroid gland, and the remission consequent to medical treatment are findings as unusual in thyrotoxicosis as they are usual in the thyrotrophic syndrome. The association of syringomyelia with paralysis of the cervical sympathetic induced Brain to conclude that the integrity of this nerve was not necessary for the development of exophthalmos in thyrotoxicosis, although this view is contrary to the general belief; whereas it seems more probable that the case afforded clinical corroboration of the experimental findings that an intact cervical-sympathetic nerve is not necessary to the development of the thyrotrophic variety of exophthalmos.

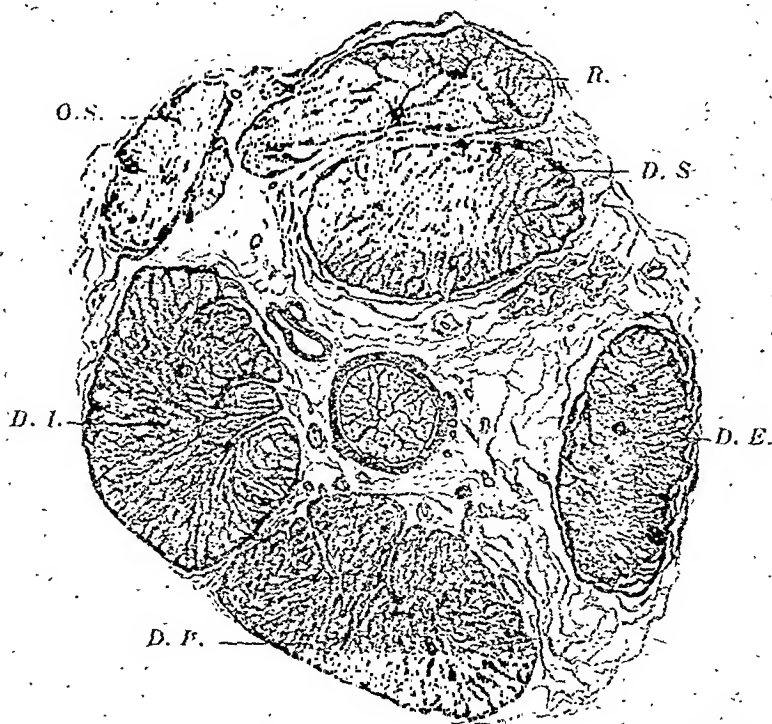
## II. PATHOLOGY OF THE EYE-MUSCLE CHANGES IN THYROTROPHIC EXOPHTHALMOS

The features of this morbid process, first described in detail by Burch (1929) and Naffziger (1933), contrast sharply

with the thyrotoxic pathology. The pathologic change is governed by four main elements; namely, a special type of muscle degeneration not marked by nuclear reduplication, a heavy increase of perimucular and interstitial fibrosis, the presence of edema, and generalized round-celled infiltration. The degree of development of these four factors is variable in each case, but their sum total re-

placed by a hard rubbery substance which causes the muscles to creak on section. Sometimes, as Naffziger has pointed out, the muscles may be darker than normal, probably denoting a slower and more fibrous development. Although of greatest extent in the eye muscles, the muscle disturbance is probably generalized, as Paulson (1939) has shown to be the case experimentally. It seems, as in thyro-

Fig. 17 (Mulvany). Thyrotoxic exophthalmos. Transverse section of orbit showing gross enlargement of extraocular muscles. Edema and heavy fibrosis are clearly evident (Rochon-Duvigneaud and Onfray, 1906).



sults in enlargement of the eye muscles. The increase in size is variable and may be gross, instances being on record in which the normal circumference of 8 to 10 mm. has been extended to 60 to 70 mm., causing the muscles to resemble "young cigars" (fig. 17). The increased volume leads to bulging of the orbital contents when the cavity is opened, affording a contrast to the flabby muscular attenuation of thyrotoxicosis. Alteration in color and consistence is prominent. The healthy appearance is converted into a pale and grayish hue and the normal soft structure

toxicosis, that the eye muscles again are prone to be affected in greater extent than those elsewhere.

Details of the changes may be considered under the headings of the four main processes operative within them:

*a. The process of fibrosis.* This feature, predominant in the slower type of case, is responsible for the hardened consistence of the muscles. It appears to develop in two main ways, either as a fibrous conversion of the sarcoplasm or as an expansion from the fibrous tissue within the vicinity. Both methods are of importance but not equally so, for it is apparent that the former, spreading slowly along the length of the muscle fiber, is likely to be asso-





Fig. 18 (Mulvany). Eye muscle from case of thyrotrophic exophthalmos, showing fibrous conversion of muscle fibers. Almost normal muscle fiber (m.f.1), partially converted muscle fiber (m.f.2), completely altered muscle fibers (m.f.3).

ciated with a slower and lower grade of ocular disturbance. The diffuse fibrous expansion, on the other hand, is more serious, for there is greater swelling of the muscles due to edema, more impairment of eye movement, and a higher retrobulbar pressure.

Fibrous conversion of the sarcoplasm, although not peculiar to this disease, is often well developed. Starting, as a rule, at the base of a fasciculus, it spreads along the fibers until the

whole length is involved (figs. 18, 19). Sometimes the fibrosis jumps ahead, leaving a gap of fairly normal tissue, or else it may appear in the center of a fiber and spread in both directions. The sarcolemma is affected in similar fashion.

The diffuse type of fibrous expansion involves the perimyscular and interstitial tissues. The perimyscular spread is coarse, being mostly fascicular and keeping to the broad outlines of



Fig. 19 (Mulvany): Thyrotrophic exophthalmos. Eye muscle showing fibrous conversion of muscle bundles (m.b.), edema, and some slight round-celled infiltration.





Fig. 20 (Mulvany). Thyrotrophic exophthalmos. Eye muscle showing heavy perimucular fibrosis (f.), edema of muscle fibers (m.f.) and interstitial tissues, and one small area of perivascular cellular spread.

the bundles, but numerous ramifications pass inward between the individual fibers (fig. 20).

At the same time a delicate fibrous network is developed transversely between the individual fibers, being derived from scattered fibroblasts some of which originate by metaplasia of disintegrating sarcolemmal cells.

As a result of the intimate investment of the fibers, the swollen contour of the muscle is retained and may even increase after complete absorption of the sarcoplasm, owing to the effective retention of the edema within the fibrous compartments. The end result, if the patient survives the associated ill effects, is one of diffuse fibrosis of the retrobulbar tis-

sues, which become fused into a conglomerate mass in which all trace of muscle tissue is lost save to microscopy, whereby a few scattered fragments may be detected (fig. 21).

*b. The process of edema.* Although this feature is constant, being present in all sections of biopsy material from eight cases, its development in most instances probably represents a later stage than the fibrosis process. This would appear to be so for at least three reasons. First, many cases are of mild character and long duration whereas others undergo spontaneous arrest. This type of progression is not suggestive of a mechanism based upon an edematous process even though the fluid may

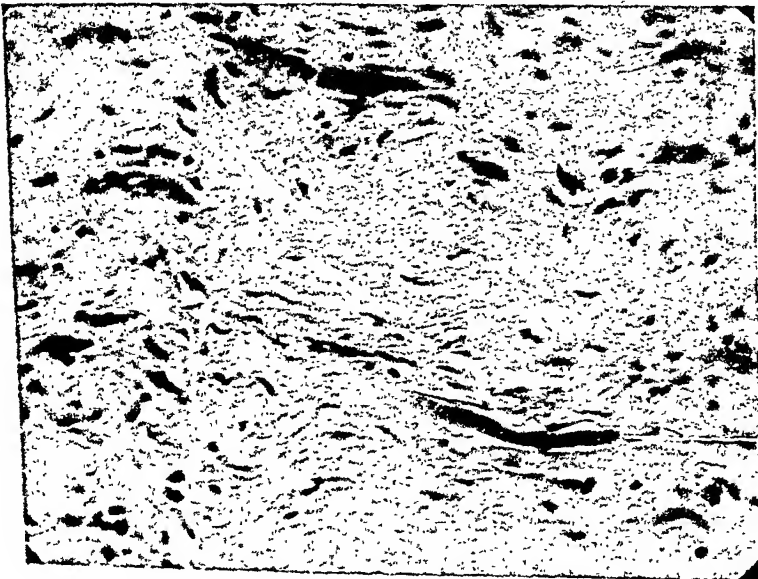


Fig. 21 (Mulvany). Thyrotrophic exophthalmos. Portion of orbital contents consisting of fibrous tissue containing few remnants of muscle tissue (m). Clinically, appearance suggested cavernous-sinus thrombosis.



Fig. 22 (Mulvany). Thyrotrophic exophthalmos. Eye muscle showing dissolution and absorption of muscle fibers. Note dark bands due to areas relatively more resistant to absorptive process.

be very thick. Second, areas affected by edema often contain portions of muscles showing advanced fibrous change in the course of disruption, suggesting that the slower fibrotic process has been overtaken by edematous infiltration. Third, evidence of fibrosis without edema has been noted but the converse is rare, although Smelser stated that fibrosis was not marked in his series. It is certain that the fibrosis is less likely to be highly developed in the acute primary case and in the experimental variety when the proptosis appears in a few weeks: changes resulting in rapid swelling and disintegration achieve by speed what the fibrosis does in time.

Whatever the primary cause of the edema may be, its development is probably aided by lymph stasis. The diffuse fibrous investment of the muscles interferes with their lymphatic drainage, which is further obstructed by the disruption of the various fibers and bundles. This obstruction accentuates the swelling of the muscles and leads to more retardation of the lymph flow. The vicious circle thus started is sometimes aggravated by pressure of the enlarged muscles on the main venous ophthalmic return.

*c. The process of muscle-fiber degeneration.* The earliest change frequently appears to consist of slight swelling and loss of transverse

Fig. 23 (Mulvany). Thyrotrophic exophthalmos. Eye muscle showing edema, marked round-celled infiltration, and absorption of muscle fibers.



striation (figs. 18, 22). Although widespread, loss of this striation is occasionally absent and cross markings may be decipherable when the fiber is in the last stages of destruction. Later changes depend upon the dominant factor of the morbid process which may be either fibrosis or edema. The latter appears to accelerate the degeneration of the fibers. The sarcoplasm assumes a fibrillary appearance and fragmentation is common, sometimes occurring at several places simultaneously in a single fiber (fig. 23). Absorption of the muscle protoplasm is progressive but irregular, often leaving bands of darker hue due to areas of relatively unabsorbable material along the course of the fiber (fig. 22). As absorption proceeds, the fiber becomes paler and more transparent until the sarcoplasm completely disappears. In certain areas the sarcolemma survives the destruction of its contents, but usually its disintegration is coincident with, and may anticipate, that of the fiber proper. Sometimes, fusion of contiguous sheaths may create the impression of nuclear reduplication. After absorption, the original site of the fiber can often be made out by the persistence of its fine fibrous investment.

*d. The process of round-celled infiltration.* This feature, most abundant where there is edema, consists predominantly of a lymphocytic infiltration. The cellular exudation is most marked in the neighborhood of the vessels and may be excessive, resembling in intensity the extravasations found with lymphatic leukemia (fig. 23). The vessels from which these cells are derived are often engorged and may contain an abnormally high percentage of lymph cells, as if in preparation for extrusion. Red cells may be abundant in certain areas and are not the result solely of trauma, as they are intimately mixed with the white cells. Small to moderate numbers of plasma cells are also present, and a few phagocytes, dealing with degenerated portions of muscle fibers, may be visible.

*e. Other orbital structures.* The other tissues of the orbital space may undergo little change. In the first patient operated upon by Naffziger, it was noted that the contents of the muscle cone were compressed into the smallest dimensions, the fat apparently being absent. In certain advanced instances, the orbital fat may become edematous and infiltrated by round cells. The chemosed conjunctiva contains plasma and polymorphonuclear cells with relatively few lymphocytes.

The lacrimal glands, as in experimental thyrotrophic proptosis, generally show marked changes. Reese (1935) in two postthyroidectomy cases noted the glandular tissue to be in all stages of degeneration, being affected by fibrosis and edema with lymphocytic infiltration. In certain areas, the lymphocytes gave rise to foci of considerable size, and the picture resembled the pathologic changes occurring in the muscles. The orbital tissue between the gland and the muscles was apparently normal. In the experimental variety, Paulson (1937) found the alveoli of the lacrimal gland to be abnormally dilated with large areas of degeneration as shown by nuclear break-up, pyknosis, and vacuolation of the gland cells. Fibrosis was obvious and in many cases sustained the architecture of the gland after the disappearance of the secretory cells. Clinically, enlargement of the lacrimal gland, as noted by Naffziger, may be a prominent feature, being easily palpable to the inquiring finger.

The larger vessels and nerves escape involvement. The smaller terminal vessels to the muscles and lacrimal glands are engorged and may be edematous, but are not inflamed. The smaller terminal nerve twigs are affected by the muscle edema and undergo absorption; the larger branches are resistant to the degenerative process.

*Summarizing*, it may be said that the four elements of the pathologic process as outlined above together with the absence of nuclear proliferation of the muscle sheaths constitute a complete contrast to the morbid process of thyrotoxicosis.

### III. SYMPTOMATOLOGY OF THYROTROPHIC EXOPHTHALMOS

It would be surprising in two conditions whose main features comprise hyperthyroidism and exophthalmos if

their points of resemblance were not on occasion to render differentiation somewhat difficult. Yet, concerning the proptosis, this should not be unduly prominent except in certain early, mild, or slowly developing instances of the thyrotrophic variety, when it is often less a matter of discrimination than of deciding whether any abnormality exists.

In general, three stages in the evolution of the ocular manifestations may be recognized (fig. 24): (a) The first stage, which may be termed the incipient, occupies the phase in which the proptosis takes

other hand, the first stage may last several years as recorded by Pletneva (1932), who describes a case in which a period of 10 years passed before the development of the congestive phase and subsequent loss of one eye. The writer has under his care two cases of 6 and 10 years' duration, respectively, during which interval the condition of the patients has varied very little. It seems that some of the milder types never progress beyond the incipient phase, a characteristic which may depend on the tendency of the disease to assume a stationary turn.



Fig. 24 (Mulvany). Thyrotrophic exophthalmos showing incipient, ingravescence, and malignant stages of the process. The second and third stages occurred three and seven months after thyroidectomy (Merrill and Oaks, 1933).

place as a result of the gradual enlargement of the eye muscles without much rise of the intraorbital pressure. (b) The second or ingravescence stage, marked by congestion and edema and a steady progression in severity, follows a general rise of intraorbital tension. (c) The third stage, appropriately termed the "malignant," is characterized by the onset of corneal ulceration followed by loss of the eye unless relieved.

The first stage is variable in its appearance and duration. Commonly it varies between one and two years but instances are on record of the severest phases having developed within six months [Merrill (1924), Smelser, personal communication]. In the case reported by Stallard (1936), a mild stage 1 was converted into the malignant third degree within a matter of three weeks following a single injection of thyrotrophic hormone. On the

The second or ingravescence stage develops in response to a material rise of intraorbital tension. It is steadily progressive and generally lasts from a few weeks to a few months. The increased severity locally is not necessarily associated with any change in the general condition of the patient but is accompanied by evidence of local circulatory disturbance and incoordination of ocular movement. The precipitating agent is probably found in the compression of the venous arcade at the base of the lids by the pressure of the prolapsing orbital septum and the enlarged muscles behind it. Edema of the lids and conjunctiva follows, and pain may become a distressing feature.

Progression of the proptosis into the third or malignant stage is usually inevitable when the preceding phase is not checked. The ulcerating process is accompanied by severe pain and leads fair-

ly rapidly to perforation and panophthalmitis with consequent loss of the eye. Rarely, at this late juncture, spontaneous improvement may be noted; it is due possibly to the lowering of the intraocular pressure following rupture of the cornea and to the apparent tendency of the condition to subside if given a chance to do so.

**THE OCULAR MANIFESTATIONS.** Possibly the most singular clinical feature is the tendency of the proptosis to develop more prominently on one side than on the other, so that early cases may appear to be unilateral. In most instances this one-sided appearance is more apparent than real, for it is usually possible by means of the scleral test to detect the presence of a slight degree of proptosis on the seemingly normal side. The other clinical features are mainly subjective, although fullness of the lids not due to edema is fairly constant. They may be considered under the grouping of symptoms and signs.

**Symptoms.** These are five in number and may be present in any combination. In mild cases, the condition may be symptomless at the start.

1. *Pain*, which may be absent, is of two types: (a) A throbbing, aching, or burning sensation behind the eyes or sometimes just a feeling of retrobulbar uneasiness. Characteristically, it is worse in the mornings and is a fairly common feature. (b) An intense form of ophthalmic neuralgia referred to the supraorbital and infraorbital regions, more commonly the former. Attention was first drawn to this distressing complication by Stellwag (1869) in a patient reputed to have Graves's disease; he had severe pain in the forehead coupled with dilatation of the ciliary veins and a baglike swelling of the lower lids. The pain is probably due to the high intraorbital tension but also accompanies the perforating process. So intense may it become that morphia may

fail to give relief and its uncontrollable nature has on occasion formed the main indication for enucleation.

2. *Lacrimation*, a frequent and troublesome feature and sometimes constituting the most prominent symptom. It does not depend upon exposure, as in exophthalmic goiter, for it may form the earliest item to be noted. Its origin probably depends upon a disturbance of the secretory activity of the lacrimal gland, which pathologically shows gross changes and clinically may be palpable. Naffziger noted its enlargement in four out of eight cases.

3. *Photophobia*, a less common but rather irritating feature. Artificial light is resented more than sunlight and the discomfort may cause the patient to change his occupation if nocturnal.

4. *Diplopia*, less usual as an early symptom but by no means a late accompaniment. Characteristically, it is most evident on looking obliquely upward and is constant in position although increasing in severity with the progress of the disease. A definite squint is rare, and it is only in the late second or third stages that some loss of parallelism of the ocular axes may occur. It is not improved by rest, being often worse on awaking, but improvement tends to follow during the day. In mild cases, the disability may be overcome and fusion accomplished. The administration of prostigmine is without effect. In respect, therefore, to its constancy of position, its lack of improvement after rest or prostigmine administration, to the rarity of strabismus and the tendency of the disturbance to affect upward rather than lateral movement, the diplopia presents noticeable differences from the disturbance of eye movement in thyrotoxicosis.

5. *Difficulty in convergence*, a less frequent symptom but one which may be the first to cause the patient to seek advice. Examination usually shows that this fea-

ture is associated with some other defect of muscular coördination.

**Physical signs.** 1. *The proptosis*, early and constant, yet often slight and difficult to define unless the scleral test is accurately applied, is not uncommonly of unequal development on the two sides. Slow in appearance in the mild case, progress may be rapid in the postthyroidectomy patient when an advanced state may be reached within a few weeks of the operation. In the primary forms also a fairly rapid progression may sometimes be

and a characteristic one, is the sensation of resistance encountered on attempting to assess the retrobulbar tension. In all cases this is above normal, but in advanced instances the pressure behind the globe may be so marked that one gains the impression of squeezing a knob embedded in cement. The maneuver is resented by the patient. Lastly, the swollen lacrimal gland and the insertions of the enlarged recti muscles are often palpable or visible. In thyrotoxicosis the lacrimal gland is never swollen, but the insertions of the



Fig. 25 (Mulvany). Thyrotrophic exophthalmos. Incipient phase stationary after six years; 24 mm. of proptosis. Note how absence of lid spasm tends to mask degree of protrusion of globe when viewed from in front.

noted. Thus, in a case of Smelzer's, one eye was lost within five months of an onset consisting merely of fullness and lacrimation; on the other hand, a slight degree of proptosis may have existed for several years before an accentuation of the process takes place. In other instances, the proptosis may become stationary in the first stage. Three other points require mention in this connection. One is the extreme degree of proptosis which may occur in the advanced case and which greatly exceeds that seen in exophthalmic goiter. Thus, Naffziger mentions the figure of 34 mm. in one of his patients, and the writer has seen one with 28 mm. and 30 mm. of exophthalmos. Another point,

voluntary muscles may sometimes be seen, and in extreme cases, as noted by Basedow, may divide the globe into quadrants like cords around a bale of goods, particularly if associated with a lowered tension consequent to intraocular perforation.

The proptosis differs from that of exophthalmic goiter in at least seven important respects: a, *The presence of subjective phenomena* as outlined above. b, *The unequal development* of the proptosis which is not infrequent. c, *The absence of lid spasm*, permitting free eversion of the lids. d, *The degree of proptosis* which, owing to the absence of lid spasm, is more real than apparent in



contradistinction to the thyrotoxic variety which, owing to the width of the palpebral fissure, is often more apparent than real (fig. 25). e, The *sensation of hard resistance* in estimating the retrobulbar tension. In thyrotoxicosis, the eye can usually be pushed back into the orbit by firm pressure although it quickly returns to its former position on being released. Even in longstanding cases the resistance although firm is never marked by the stony hardness of the thyrotro-

each of which favors the development of the other so that high degrees of exophthalmos, apart from ptosis, are associated with wide lid retraction which may nearly reach the equator of the eye. In these cases, any movement such as sneezing, coughing, or jerking of the head may easily produce forward luxation, owing to lack of tonic retraction of the voluntary muscles. In the thyrotrophic variety, the palpebral tissues are often pushed forward with the globe and in any case

Fig. 26 (Mulvany). Thyrotrophic exophthalmos. First stage of proptosis showing characteristic glistening of conjunctiva and fine vascular congestion.



phic variety and the examination is not painful. Clinical evidence of increased retrobulbar pressure is often associated. f, The *presence of congestive features* manifested in the earliest phase by a peculiar glistening of the ocular conjunctiva and the presence of a fine network of venules over its surface. Both of these factors are probably caused by a restriction of venous and lymph return made through the anterior ciliary vessels linking up with those of the fibrosing recti muscles (figs. 25, 26). Edema of the lids and chemosis never occur in exophthalmic goiter except as an accompaniment of an infected keratitis. g, The *rarity of dislocation of the globes* in front of the lids, the explanation lying in the dissimilitude of the respective proptotic mechanisms. In thyrotoxicosis, the proptosis and lid retraction are conjoined expressions of a single process

their retraction behind the globe is effectively prevented by the swelling and stiffness of the eye muscles.

2. *Upper-lid retraction*, an early feature in the course of the disease. Its appearance has no connection with sympathetic activity as its development experimentally in the thyrotrophic type is not prevented by section of the sympathetic nerve in the neck; nor with hyperthyroidism, as this is often absent. Its presence is due to a mechanical disturbance of the normal relationship of the upper lid to the globe brought about by pathologic change in the orbit and particularly in the levator palpebrae. Normally, as pointed out by Pochin (1938), the upper lid possesses an accommodating power of stretching so that its relationship to the globe is but little disturbed by a simple exophthalmos up to 10 mm. In thyrotrophic exophthalmos this power of



accommodation is lost, owing to loss of elasticity in the levator muscle. Hence, as the swelling of the voluntary cone of muscles displaces the levator upward, the muscle is affected by a relative shortness, owing to fibrosis and its fixation posteriorly. Thus, minor degrees of thyrotrophic proptosis are often accompanied by upper-lid retraction. Later, as the orbital septum is prolapsed into the lid and edema supervenes, retraction be-

with increasing upper-lid retraction. Some diminution of lateral movement is generally apparent about this time, but downward motion seems little altered.

The constancy of the association of loss of upward movement with upper-lid retraction invites an explanation. One may be found in the mechanical frustration of individual mobility of the swollen levator and superior-rectus muscles through their being conjoined in a good

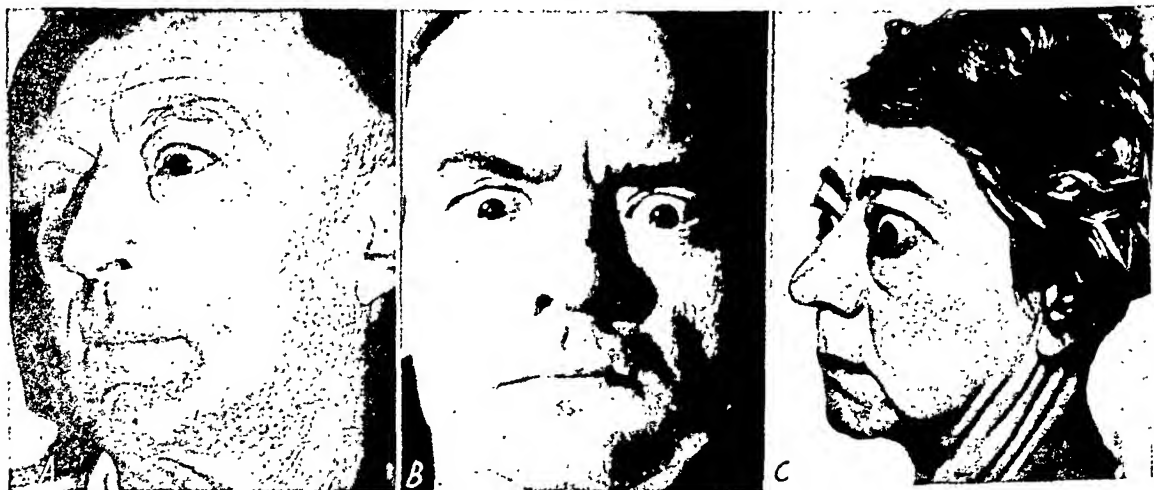


Fig. 27 (Mulvany). Thyrotrophic exophthalmos. Pathognomonic appearance often apparent at commencement of second stage: A (Thompson and Woods, 1936); B (Shannon and Gouterman, 1936); C (Naffziger, 1938).

comes less noticeable and may even be replaced by a pseudoptosis due to swelling of the lid.

3. *Disturbance of muscular co-ordination*, readily understood from the nature of the pathologic change, is often an early accompaniment. Possibly the first indication of this is an exaggeration of the curious nystagmoid oscillations normally associated with eye movement when following a rapidly moving object. Next, a restriction of ocular mobility occurs, usually affecting elevation in the first place although a slight reduction of extreme lateral movement may also be noticeable. Later in the first stage, upward movement becomes greatly affected and may be lost usually in conjunction

part of their course, posteriorly by their origin from a common stem and anteriorly by an intimate fascial connection between the two tendons. The remaining orbital muscles, although greatly enlarged, are able to retain independent action for a much longer period, probably until their increasing girth has given rise to great increase of intraorbital tension or to mechanical hindrance locally. Thus it may happen that toward the end of the first stage the exophthalmos acquires certain characteristics which constitute a truly pathognomonic picture (fig. 27). The patient appears with a moderate proptosis, evident retraction of the upper lid, and slight depression of the globe owing to loss of upward movement. Full-

ness of the palpebral folds and evidence of increased retrobulbar pressure are usually associated.

The degree of limitation of eye movement appears to be related as much to increasing intraorbital tension as to the interstitial break-up and edema of the muscles. With chemosis, the tight application of the lids to the global surface is probably also a factor. Ultimately, complete immobility ensues, the mechanical basis of which is shown by the rapid return of eye movement following orbital decompression. The improvement is seldom perfect in these severe cases and in rare instances may be negligible, owing to the extent of the pathologic change in the muscles. In one case, the retrobulbar tissues were converted into a conglomerate fibrous mass containing only minute fragments of muscle tissue.

The nature of the disturbance of eye movement, partly mechanical, partly due to local muscle disease, is clearly not produced by a lesion of the central nervous system nor of the local oculomotor mechanism; hence the undesirability of terming it an ophthalmoplegia. In this respect the loss of eye movement differs from that occurring in exophthalmic goiter, which, in the full sense of the word, is a true ophthalmoplegia.

4. *Local vascular alteration* first makes its appearance as a fine network of venules in the ocular conjunctiva, particularly in the fornices, the surface of which assumes a curious but characteristic glistening character not seen in thyrotoxicosis. The conjunctival changes are accompanied by a bagginess of the eyelids, particularly of the lower, which at this stage is caused not by edema, but, as in thyrotoxicosis, is due to prominence of the palpebral tissues consecutive to the proptosis. As the congestive phase develops, a true edema of the lids and conjunctiva appears due to venous palpebral

obstruction and not to waterlogging of the retrobulbar tissues, as Charpy (1931) has shown, by means of injections into the retrobulbar and intracapsular spaces, that liquid does not diffuse through to the lids.

The onset of these edematous changes adds greatly to the seriousness of the local condition, as it impedes closure of the lids. It is then only a matter of time before corneal ulceration of the progressive and irresistible type follows. Congestion and swelling of the optic disc, often with retinal hemorrhages, is also found and is due to direct pressure of the swollen muscles on the optic vein. Its association is variable and it may be absent in certain severe instances. Retinitis pigmentosa has been described by Zimmerman (1929). Provided pressure is relieved before vision has completely failed, a good recovery may be expected, although in severe and long-standing cases some degree of optic atrophy may follow. Complete blindness due to this cause is rare. The interval between the papilledema and optic atrophy is generally a few months, but in one instance (Pletneva, 1932) it ended 14 years after corneal ulceration had resulted in the loss of one eye.

#### IV. TREATMENT OF THYROTROPHIC EXOPHTHALMOS

General measures calculated to reduce the thyrotrophic and gonadotrophic output of the pituitary gland comprise direct and indirect methods.

The simplest direct measure is the employment of X-ray radiation, and its application as in acromegaly will result in a variable degree of improvement. For instance, a woman, aged 72 years, with two years' history received a dosage of 1,500r units over a period of 10 days. By the end of treatment, the patient had lost her diplopia and on discharge showed

a fall in the B.M.R. from +54 to +26 percent, a drop in the pulse rate of about 30 beats a minute, and a marked general improvement which was maintained six months later, since when the patient has not been seen. On the other hand, a man, aged 54 years, with a four years' history of proptosis and a slight metabolic rise varying between +24 and +15 percent showed only a slight fall of some 10 points in the basal metabolism and but small change in the exophthalmos on a similar dosage of the X-ray. It seems likely, particularly in regard to the proptosis, that the best result may be expected in the acute types on account of the lesser development of fibrosis in the eye muscles.

Indirectly, the secretory activity of the pituitary may be influenced by the administration of various substances of which the most practical are thyroid extract and iodine. In connection with thyroid activity, it has been shown by Marine, Rosen and Spark (1935) that the giving of iodine to rabbits affected with a parenchymatous goiter causes a decrease in the size and number of active cells in the pituitary gland which are probably concerned with the thyroid enlargement. Iodine medication, however, had no effect on the activity of the cells in rabbits previously subjected to a thyroidectomy, an observation in accord with the finding that iodine has little or no effect on the progressive exophthalmos following this operation.

In this connection it should be remembered that not all cases of postoperative ocular disturbance are indicative of hypophyseal dysfunction, as some of them denote a recurrence of toxic goiter. Thus Zimmerman (1929) describes eight cases of exophthalmos following operation for the relief of hyperthyroidism. Of these, it seems probable from the data that four cases, all in males with ages

from 37 to 53 years, were examples of thyrotrophic exophthalmos. The remainder, all in women, were more probably instances of exophthalmic goiter. In two of this latter group, mention is made of the use of iodine, and it is interesting to note, apropos of its small value in postoperative thyrotrophic proptosis, that its effect was beneficial. In the primary type of thyrotrophic exophthalmos, unless of very longstanding, improvement follows iodine administration, the response being slow but good and maintained during the employment of the drug. One patient treated in this way for two years showed a progressive fall in the B.M.R. from +36 to +14 percent, with moderate improvement in the exophthalmos. It would appear that the value of iodine in this disease is much the same as in acromegaly, in which the hyperthyroidism is thyrotrophic in source. Friedgood (1936) describes a case of acromegaly on iodine in which the B.M.R. fell from +43 to +32 percent after six months and again to +27 percent after a further six months. In another patient, the B.M.R. was reduced some 10 points by similar methods but rose again to about 30 points after its administration was stopped.

Estrin and related compounds may have an effect similar to that of iodine, owing to the depression of gonadotrophic and thyrotrophic output which follows its administration. Its employment is probably safe, as Marine has shown that its dispensing to castrated animals treated by injections of pituitary extract did not develop exophthalmos. Results, however, have proved uncertain in spite of large dosage. Possibly it is of most value in postmenopausal cases in conjunction with thyroid extract as an alternative to iodine. Stilbestrol, on account of its inexpensiveness, is a suitable agent and may be given in doses of 5 to 10 mg. daily.

More potent than either of the former remedies is the influence of thyroid extract. Although it may appear paradoxical to administer thyroxine to patients already subject to hyperthyroidism, nevertheless its exhibition may lead to improvement, particularly in regard to the exophthalmos, which, having no relation to the associated hyperthyroidism, is unlikely to be affected by a temporary increase of the basal metabolism. In one

been no relapse. No photographs exist, unfortunately, to record the patient's progress, but the clinical appearance before and after improvement strongly resembled that in Gasteiger's case (fig. 28).

The postoperative exacerbation is more resistant to general measures, owing to the abnormal stimulus to the pituitary gland provided by the operation. Iodine is of little avail and requires to be supple-

Fig. 28 (Mulvany). Thyrotrophic exophthalmos. Postthyroidectomy progression cured by thyroid administration (Gasteiger, 1931).



such case, a man aged 56 years with a six months' history, presented a second-stage proptosis, having complete immobility of the left eye and considerable restriction of movement in the other, chemosis, bloodstained lacrimation, and edema of both lids. The B.M.R. was about +20 percent. On two grains of thyroid daily, the improvement was so rapid and dramatic that the patient was back at work as a garage hand within six weeks of being bedridden. When seen a short time ago, there was no clinical evidence of hyperthyroidism, and the patient's eyes had reverted almost to normal, full movement being restored and only a slight degree of exophthalmos remaining as shown by means of the scleral test. The thyroid administration has since been stopped and there has

mented by large doses of thyroid extract. Owing to the small amount of thyroid secretion present, a daily dose of 5 grains will be well tolerated but the quantity may be increased to  $7\frac{1}{2}$  to 10 gr. when a rapid result is required. This dose may raise the B.M.R. to about +30 percent, but it seems that this degree of hyperthyroidism is not badly borne, possibly because it is not accompanied by the sympathetic overaction of thyrotoxicosis. When improvement is manifest, the dose may gradually be reduced but will have to be continued for a variable period of months to years until the disease has subsided or became stationary.

Of local measures, none are required in the first stage and are usually too late in the third. It is in the progressive sec-

ond stage that active measures will give most success. Plastic operations are of little avail, owing to the uncompromising retrobulbar pressure; hence lid suture, as Jessop put it in 1896, is "not to be recommended in cases of Graves's disease with chemosis and deep ulceration of the cornea." Local operative measures, such as the partial decompression of the Foster Moore or Krönlein type, seldom prove of value except in the milder kind of disturbance.

The only operation likely to be of real service is the orbital decompression devised by Naffziger or some modification of it. Naffziger carried out the measure through a transfrontal approach, and the extent of the decompression is very important if adequate relief is to follow. The distance to which the frontal sinuses extend into the orbital plates is a factor of consequence, as their extension backward may sometimes be so great that a sufficient removal of bone from the frontal fossa may be impossible. In order to overcome this difficulty, Naffziger advised removal not only of the roof but also of the bones leading into the temporal fossa and close to the orbital rim. Posteriorly to this, the removal of bone was continued into the middle fossa, including the postero-lateral portion of the orbital wall down to the orbital fissure. The presence of papilledema required the unroofing of the optic foramen, a maneuver which greatly enhances the value of the operation.

A lateral approach, as advocated by Swift (quoted by McCravey and Mather) is less formidable, shorter, and allows a speedier convalescence. It has, therefore, much to recommend it although some difficulty may be experienced in securing the radical removal of bone, which is possible by the transfrontal approach.

The results of both operations are ex-

cellent, but it is important that the measure be adopted before ulceration or other complications have developed. The operation is followed by immediate recession of the eyes, and improvement continues slowly for some time. Naffziger mentions one patient, operated upon six years previously, who at the time of examination appeared to have normal vision and eye movement. The measure, however, is palliative only, as is shown by the progressive enlargement of the eye muscles after the intraorbital tension has been completely relieved by loss of the globe. Thus, Merrill and Oaks (1933) mention a case in which the "stump progressively protruded . . . and remained until death two years later so prominent that the eyelids could not be closed over it." Thompson and Woods (1936) recall a similar case in which the progressive bulging of the stump between the lids necessitated a plastic operation to remove it.

A final word of caution regarding accurate diagnosis. This is important as the hasty performance of a thyroidectomy in a case of thyrotrophic exophthalmos may precipitate disaster as much as would the performance of an orbital decompression in the thyrotoxic patient.

#### EXAMINATION OF CERTAIN CONTROVERSIAL PROBLEMS IN LIGHT OF DIFFERENTIATION

1. *Correlation* between the majority of diverse and apparently opposed views—experimental, clinical, and pathologic—is possible on a two-fold basis.

2. *Mechanism of proptosis* is clearly of two types, each being uninterchangeable and peculiar to its own particular state. The part played by the sympathetic nervous system and thyrotoxic myasthenia and atonia in relationship to thyrotoxic exophthalmos and that by retrobulbar pressure to thyrotrophic

proptosis is definite and simple to follow. In classical Graves's disease there is no evidence, either clinically or at autopsy, of a raised retrobulbar tension and the presence of this feature is sufficient to indicate the nonthyrotoxic nature of the disturbance. On the other hand, an increased intraorbital pressure is a constant feature of thyrotrophic exophthalmos.

3. *Lid retraction.* In thyrotoxicosis this is due to spasm of the smooth muscle in the lids and is dependent upon sympathetic overaction. There is no evidence to show that it is connected with contraction of the striated levator. Blocking of the cervical sympathetic impulses by infiltration or removal of the lower ganglion improves or cures the condition. On the other hand, the lid retraction of thyrotrophic exophthalmos is nonspastic, being due to a disturbance of the power which the upper lid normally possesses of being able to accommodate itself to the globe. As a result of enlargement of the extraocular cone, the levator is displaced upward and, being stiffened and swollen and fixed posteriorly, is affected by a relative shortness resulting in the appearance of upper-lid retraction.

4. *Congestion and edema.* These features do not form part of the thyrotoxic syndrome except in response to local ulceration and infection. Edema, however, is a constant feature of thyrotrophic exophthalmos, being manifested first in the curious glistening character of the ocular conjunctiva. Later, wrinkling of this membrane, on rolling the eye, is visible, and chemosis develops, being quickly followed by corneal ulceration and perforation, if left unrelieved.

5. *Lid suture for corneal ulceration.* The corneal ulceration of thyrotoxicosis is usually of a superficial grade and is able to respond to lid suture even when edema due to local sepsis complicates the picture, provided local tension is relieved by ade-

quate tarsorrhaphy. In certain instances healing will occur spontaneously, even in the absence of treatment to the gland, but delay in carrying out a thyroidectomy should be avoided. On the other hand, in thyrotrophic exophthalmos lid suture is not advisable nor without danger, as it aggravates the tension of the lids across the corneal surface. The remedy lies in the checking of the irresistible retrobulbar force and consists of an orbital decompression. At the same time, it should not be overlooked that the performance of this operation for thyrotoxic exophthalmos, apart from being useless, is liable to be followed by disaster.

6. *Disturbance of eye movement and eye palsies.* In exophthalmic goiter, this feature is the result of the unequal development of thyrotoxic weakness in one or more of the eye muscles. In the early stages, it may show properties common to other myasthenic processes, such as improvement after rest or a response to prostigmine administration. Most frequently the internal or external recti muscles or the levator is affected, but the disturbance is very irregular and usually differs on the two sides. In thyrotrophic exophthalmos, eye movement is affected early in the course of the disease, usually in an upward direction, being due mainly to mechanical hindrance occasioned by the swelling and stiffening of the conjoined levator and superior-rectus muscles. Later, as intraorbital pressure rises, eye movement becomes limited in all directions and may be lost. Myasthenia, however, plays no part in this latter development, and the response to prostigmine is absent.

7. *Dislocation of the globe.* This has occurred in thyrotoxicosis, owing to the width of the palpebral fissure and the laxity of the extraocular muscles. Occasionally, movements, such as coughing and sneezing, may be sufficient to produce

it. On the other hand, dislocation is practically impossible in thyrotrophic exophthalmos, as the lids are unable to retract over the enlarged voluntary muscles.

8. *The basal metabolism.* In thyrotoxicosis this is consistently raised while the proptosis is developing. In the thyrotrophic condition, hyperthyroidism bears no relation to the proptosis, and particularly severe instances have appeared after a thyroidectomy has been carried out when the basal metabolism is low.

9. *The effect of thyroidectomy.* This is beneficial in thyrotoxicosis, as the operation removes the cause of the trouble. The proptosis is improved or not altered. Thyroidectomy for thyrotrophic exophthalmos may produce unfortunate results, as the operation, while curing the hyperthyroidism, stimulates the pituitary body to greater secretory effort and results in

greater thyrotrophic formation. Progression of the proptosis after thyroidectomy in thyrotoxicosis can be due only to insufficient removal or recurrence. In the pituitary variety, postoperative progression is not uncommon and may be regarded as a clinical feature.

10. *Effect of thyroid and iodine administration.* In thyrotoxicosis, iodine will be beneficial and thyroid harmful. In thyrotrophic exophthalmos, iodine and thyroid may both be of benefit, the former being most valuable prior to thyroidectomy and the latter of greatest use afterward; although, paradoxical as it may seem, the administration of thyroid in thyrotrophic hyperthyroidism may serve to lower the basal metabolism rather than raise it. Both of these substances act by reducing the thyrotrophic activity of the hypophysis.

(Part III will appear in the next issue.)



# THE ETIOLOGY AND TREATMENT OF TOBACCO-ALCOHOL AMBLYOPIA\*

## Part I

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Until very recently it was generally assumed among ophthalmologists that in certain susceptible individuals tobacco and alcohol had a direct toxic action on the optic fibers in the papillomacular bundle or on those retinal ganglion cells which sent their nerve fibers into the papillomacular bundle. The reasons for believing this were somewhat as follows: (1) There was a very definite clinical entity characterized by bilateral centrocecal scotomas which developed gradually; this entity was seen in individuals who drank or smoked, or, more commonly, who both drank and smoked. (2) Clinical experience had indicated that if patients with this condition stopped smoking and drinking before optic atrophy developed, the scotomas usually decreased markedly in size and density and the vision improved considerably. (3) If patients with this condition did not discontinue the use of tobacco and alcohol, or markedly reduce their intake, they did not improve. In a study made in 1935 the writer<sup>1</sup> found only a few exceptions to the last rule and, until his subsequent findings on the importance of diet in the treatment of this condition,<sup>2</sup> it appeared to be the consensus of medical opinion that patients with tobacco-alcohol amblyopia did not get well unless they discontinued, or at least markedly reduced, the use of these substances.<sup>3</sup>

It was impossible, however, to explain on this basis all the factors involved. Some of the more puzzling of these were as follows: Tobacco-alcohol amblyopia often occurred in an individual who had smoked and drunk the same amount over a period of many years without developing the condition. Why did poor vision develop without any increase in the intake of tobacco or alcohol if these substances actually were the cause? Did the "susceptible" individuals really have an "idiosyncrasy"? Certainly there are tens, perhaps hundreds, of thousands of heavy smokers and drinkers who never develop this condition despite their large intake of tobacco and alcohol. On the other hand, numerous patients who develop the amblyopia use these substances in moderate quantities only. Usher<sup>4</sup> found that among people over 50 years of age those with tobacco amblyopia actually used less tobacco than controls who had no amblyopia. This finding, based on a series of 1,100 cases of tobacco amblyopia and 500 control cases, would seem to have considerable significance. From it one would conclude that individuals contracting this disease must be more susceptible to the supposedly harmful effects of tobacco and alcohol. It was noteworthy, however, that these patients showed no other evidence of increased susceptibility or idiosyncrasy to these substances. Skin tests with tobacco, and peripheral vascular studies after smoking, showed no abnormalities.<sup>1</sup> Most of the heavy drinkers with this condition can tolerate a much larger amount of alcohol than can the average person without having their nerv-

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ous systems show signs of intoxication; that is, they have built up a tolerance for alcohol and, in that sense at least, have decreased rather than increased susceptibility to it.

Many thoughtful investigators in the past have called attention to factors which seemed to precipitate the onset of tobacco-alcohol amblyopia and have mentioned

bacco-alcohol amblyopia have been seen by the writer during the nine-year period 1933-1942. In 1935 the present investigation was undertaken and a preliminary report was published in 1937.<sup>2</sup> At that time eight patients with tobacco-alcohol amblyopia had been hospitalized, allowed to consume their usual intake of tobacco and alcohol, and had been given a well-

TABLE 1

TOBACCO-ALCOHOL AMBLYOPIA. SUMMARY OF RESULTS IN 25 PATIENTS WHO CONTINUED THE USE OF TOBACCO AND ALCOHOL WHILE RECEIVING SPECIAL DIETS

Case No.	Patient	Vision Before Treatment	Vision After Treatment	Time Followed months	Case No.	Patient	Vision Before Treatment	Vision After Treatment	Time Followed months
1	C.S.	20/200	20/50	25	14	R.L.	5/200	20/20 —	10
2	G.J.	20/200	20/50	5			6/200	20/20 —	
		20/200	20/30		15	W.S.	20/100	20/20	25
3	N.M.	10/200	20/20				20/200	20/20 —	
			20/40	3	16	E.S.	4/200	20/70	5
			*				4/200	20/70	
4	W.F.	20/200	20/30	73	17	A.M.	20/40	20/20 —	6
		20/200	20/30				20/40 —	20/20	
5	E.F.	FC 3'	20/20	22	18	A.N.	FC 2'	20/30	72
		FC 3'	20/20				FC 4'	20/30	
6	H.R.		*	85	19	A.B.	5/200	20/30 —	20
		5/200	20/70				20/100	20/30	
7	F.S.	20/50	20/20	76	20	L.P.	20/100	20/30	24
		20/70	20/20				20/100	20/30	
8	W.H.	15/200	20/15	80	21	C.S.	20/200	20/20 —	8
		10/200	20/15				20/70	20/20 —	
9	L.W.	20/50	20/20 +	58	22	H.F.	20/40	20/15	7
		20/50	20/20 +				20/70	20/20	
10	A.F.	20/200	20/30	55	23	R.L.	20/70 —	20/20	56
		20/200	20/30				20/200	20/20	
11	H.W.	20/200	20/20	31	24	W.R.	20/200	20/30 —	4
		20/70	20/20				20/50	20/20 —	
12	D.F.	20/200	20/15	41	25	D.W.	20/50	20/20 —	4
		10/200	20/15				20/40	20/20 —	
13	J.H.		*						
		20/200	20/20 —	21					

\* In this case only one eye was considered for the purpose of this study, the other having pathology which was in no way related to the amblyopia.

that the general nutrition of the patient appeared to affect the development of the disease;<sup>5</sup> for example, de Schweinitz<sup>3</sup> in 1896 wrote, "Other circumstances (besides alcohol) which favor a deleterious effect of tobacco on vision are malnutrition from any source, chronic gastritis, dyspepsia, mental worry, and particularly insomnia."

Approximately 175 patients with to-

balanced diet supplemented with large quantities of brewers' yeast. These patients (cases 1-8, Appendix) made very satisfactory recoveries despite their continued use of tobacco and alcohol. Since that time 17 additional patients have been allowed to continue, or have refused to discontinue, their use of these substances and have been treated in various ways in an effort to determine what factor in the

diet or in the yeast cured the amblyopia. These 17 cases, together with 8 previously reported, constitute a series of 25 consecutive patients with this condition who were able and desired to cooperate in this study and who did not have optic atrophy when first examined. The only exception to the latter specification was the first patient treated (case 1, Appendix) who had partial optic atrophy and showed only slight improvement on treatment.

Table 1 summarizes the results ob-

Eleven of the 25 patients (cases 1 to 9, 18, 23, Appendix) were given a high vitamin-B, well-balanced diet, adequate in all respects and supplemented by powdered brewers' yeast. A second group of five patients was allowed to continue on the same diet taken while developing the amblyopia and was given either yeast or vitamin-B complex in the form of tablets or in an elixir. The results of this treatment appear in table 2. Every patient in the group obtained vision of 20/30 O.U.

TABLE 2

PATIENTS LEFT ON USUAL DIET WITH VITAMIN-B COMPLEX ADDED

Case No.	Name	Vision Before Treatment	Vision After Treatment	Amount of Tobacco and Alcohol Used Daily	Amount of Synthetic Vitamin B <sub>1</sub> Taken Daily in Addition to that in the Vitamin-B-Complex Products	Amount of Vitamin-B Complex Taken Daily	Period of Observation months
17	A.M.	10/200	20/20—	1 pint liquor	20 mg.	35 c.c. Beta-plexin	6
20	L.P.	20/100 20/100 20/100	20/20 20/30 20/30	2 pkg. cigarettes 2 quarts beer ½ pkg. cigar clippings	none	yeast 25 gm.	24
21	C.S.	20/200 20/70	20/20— 20/20—	2 glasses wine 8 cigars ½ pkg. tobacco	none	24 c.c. Beta-plexin	8
22	H.F.	20/40 20/70	20/15 20/20	2 cigars 6 cigarettes	none	yeast 35 mg.	3
24	W.R.	20/200 20/50	20/30— 20/20—	1 quart liquor 6-10 cigars	5 mg.	yeast 65 gm. Vegex 12 c.c.	4

tained with the entire series; these are at least as good as results obtained by the author in any previous consecutive 25 patients with tobacco-alcohol amblyopia, including those who abstained from the use of tobacco and alcohol while under treatment. The vision in 21 of the 25 patients was 20/30 O.U. or better after treatment; in 14 it was 20/20 or better. Of the four patients whose vision failed to improve to 20/30 while under observation, one (case 1) had partial optic atrophy before treatment, one (case 6) had lens opacities and entirely disregarded his diet after his vision had improved to 20/40, and two (cases 3 and 16) were followed only three and five months, respectively.

or better. Two of them were not hospitalized, one being seen in private practice and the other in the clinic. They merely continued to eat, drink, and smoke as usual but in addition took the prescribed vitamin-B-complex products.

The patients comprising the next two groups, however, were hospitalized and observed closely throughout the period of treatment. This was necessary because they were placed on a diet that was calculated to be inadequate in all vitamins. The caloric intake was sufficient to prevent loss of weight, but such a diet of necessity provides only uninteresting monotonous meals and most of the patients did lose weight. None developed any clinical evidence of other deficiency dis-

TABLE 3

PATIENTS PLACED ON INADEQUATE DIETS PLUS THIAMIN CHLORIDE AND REST OF B COMPLEX

Case No.	Name	Vision Before Hosp.	Vision After Hosp.	Amount of Alcohol and Tobacco Used Daily	Amount of Synthetic Vitamin B <sub>1</sub> Taken	Amount of B Complex Taken	Time in Hosp.	Final Vision
13	J.H.	20/200	20/40	1 pint liquor 8 cigars	20 mg.	12 capsules (Lederle B complex)	26 days	20/20 O.S.
16	E.S.	4/200 4/200	20/200 20/200	12 oz. liquor 1 pkg. cigarettes	15 mg.	6 capsules B complex— 200 mg. nicotinic acid	18 days	20/70 O.U.
17	A.M.	10/200 20/100	20/50 20/40—	1 pint of liquor 2 pkg. cigarettes	20 mg.	36 c.c. of Betaplexin	4 weeks	20/20—O.U.
19	A.B.	5/200 20/100	20/80 20/30	1 pint of liquor 1 pkg. cigarettes	40 mg.	9 capsules B complex	4 weeks	20/30— 20/30

case, however, probably because the regime was always terminated before such conditions could occur. The reason for placing these patients on a diet inadequate in all known vitamins was, of course, to exclude the possibility that some or all the improvement might be due to something besides the vitamin-B fraction. A group of four patients on this inadequate diet was given a vitamin-B-complex product which is available commercially,\* plus synthetic vitamin B<sub>1</sub>. The results, as shown in table 3, seemed to be as good as those in the preceding ones.

As a final step patients in another group placed on this inadequate diet, who were of course also consuming their usual amounts of alcohol and tobacco, were given synthetic vitamin B<sub>1</sub> only. Any improvement in their condition could be assumed to be due to the added vitamin B<sub>1</sub>. As may be seen in table 4, the results were good and would seem to be significant.

\* Winthrop Chemical Company, 170 Varick Street, New York City, kindly provided the vitamin B<sub>1</sub> (Betaxin) and elixir vitamin-B complex (Betaplexin) used in this study.

TABLE 4

PATIENTS PLACED ON INADEQUATE DIETS SUPPLEMENTED ONLY WITH SYNTHETIC VITAMIN B<sub>1</sub>

Case No.	Name	Vision Before Hosp.	Vision After Hosp.	Amount of Alcohol and Tobacco Used Daily	Amount of Vitamin B <sub>1</sub> Taken Daily	Time in Hospital	Final Vision
10	A.F.	20/200 20/200	20/40 20/200	1 pint of liquor 1 pkg. cigarettes 1-2 cigars	43 mg.	6 weeks	20/30 O.U.
11	H.W.	20/200 20/70	20/30— 20/20	1 pt. liquor 30 cigarettes	15 mg.	5 weeks	20/20 O.U.
14	R.L.	5/200 6/200	20/200 20/200	1 pt. liquor ½ pkg. tobacco	40 mg.	4 weeks	20/20 O.U.
15	W.S.	20/100 20/200	20/20— 20/50—	1 pt. liquor 1 pkg. cigarettes	40 mg.	3 weeks	20/20 20/20—
25	D.W.	20/50 20/40	20/30 20/30	1 pt. liquor 1 pkg. cigarettes	20 mg.	3 weeks	20/20 O.U.

In the last group of cases (10, 11, 14, 15, 25, Appendix), some complications occurred. The patient in case 11 stated that he developed a dryness of the hands and pains in the arms and calves of the legs which lasted four or five days. The patient in Case 14 improved on vitamin B<sub>1</sub> until his vision was 20/70 O.U.; when nicotinic acid was added there was further improvement; finally, when the whole B complex was taken, the vision became 20/20 O.U. It is possible, of course, that the improvement might have progressed in the same way even if the other factors of the B complex had not been added. The vision in case 15 improved from O.D. 20/100, O.S. 20/200 to O.D. 20/20, O.S. 20/50 during three weeks' hospitalization on 40 mg. daily of vitamin B<sub>1</sub> and an inadequate diet, but after the patient had been home a month, during which time he continued to take the thiamin, he returned with a vision of 20/50, 20/200 and a markedly contracted field, O.U. This is the only case of tobacco-alcohol amblyopia the writer ever has seen in which such a contraction of the visual field developed. The patient was an emotional individual, but it was not possible to prove that the contraction was on a functional rather than an organic basis. The significance, if any, of this isolated finding cannot be evaluated at this time. The peripheral field returned to normal after nicotinic acid was administered, and eventually, when brewers' yeast had been substituted for the more refined preparations, vision became 20/20, O.U., without any scotomas.

In 1939 Johnson<sup>6</sup> reported five cases of tobacco-alcohol amblyopia in which the patients were treated with thiamin chloride. Two of them did not discontinue either alcohol or tobacco; one obtained a vision of 20/40, O.U., and the other 20/20, O.U. It is possible that other substances which are necessary for the proper

nutrition of the cells may also be of importance. Accurate chemical tests for the various factors of vitamin B which could be applied clinically have not been available during this study but may very well be so in the near future. Meanwhile it may be stated that a pure vitamin-B<sub>1</sub> deficiency is probably not common. Deficiencies tend to be multiple. It would seem, therefore, that in spite of the good results obtained with thiamin chloride in these cases, it would be much sounder therapeutically to administer the whole B complex rather than just thiamin. For scientific purposes it was of interest to establish the fact that definite partial or complete recovery (for example, in case 25) could take place as a result of the addition of thiamin chloride alone, but practically it appeared to be much better to give the whole B complex. It may be still more advisable to give the whole B complex plus additional B<sub>1</sub>. In addition it seems desirable to adjust the diet so that the individual is consuming more than the minimum required amounts of all essential substances.

In an effort to determine the adequacy of the diets on which these people were living while developing this "toxic" amblyopia, a careful dietary history was taken from 23 patients by the present dietitian at the Institute of Ophthalmology, Miss Jane Wark, or by one of her predecessors. While it is apparent that these histories are not absolutely accurate, and in a few instances may be considerably in error, they do tend to indicate that the diets in general were low or just border line with respect to vitamin B<sub>1</sub>. In 1934, Cowgill<sup>7</sup> calculated the vitamin-B requirement of man, and subsequent clinical studies have supported his calculations. He used the unit "milligram equivalent" in his work, which was published before vitamin B<sub>1</sub> had been synthesized. If the amount of vitamin B

ingested (expressed in milligram equivalent units) is divided by the number of calories consumed, a ratio is obtained. Cowgill showed that for a person of a given weight it is necessary to have a certain vitamin-B calorie ratio. Otherwise symptoms of deficiency eventually develop. It has been estimated that 1,600

The last two patients listed in table 5 (cases 12 and 9) had tobacco amblyopia. They were teetotalers and their vitamin-B intake seemed adequate according to Cowgill's calculation. However, when they were given large doses of brewers' yeast they both attained 20/20 vision or better, O.U. One of them (case 12) dis-

TABLE 5  
CALCULATIONS MADE FROM THE DIETARY HISTORIES OF 23 PATIENTS WITH  
TOBACCO-ALCOHOL AMBLYOPIA

Case No.	Name	Calo- ries from Food	Calo- ries from Liquor	Total Calo- ries	Vit.-B mg. Equiv.	Weight of Pt. kilo- grams	Vit.-B Calorie Ratio without Alcohol	Vit.-B Calorie Ratio with Alcohol	Mini- mum Vit.-B Calorie	Ade- quacy of Vit.-B Intake
6	H.R.	1,207	750	1,957	4,180	77	3.46	2.13	2.20	-0.07
4	W.F.	1,668	1,250	2,918	7,327	74	4.39	2.51	2.10	+0.40
17	A.M.	700	1,600	2,300	3,130	60	4.47	1.36	1.70	-0.24
	A.M.	897	1,600	2,497	3,502	64	3.90	1.42	1.75	-0.33
2	G.J.	1,333	1,600	2,933	3,840	86	2.88	1.30	2.40	-1.10
25	D.W.	1,293	1,250	2,543	2,506	45	1.93	0.98	1.30	-0.32
18	A.N.	2,466	1,450	3,916	5,988	63	2.42	1.52	1.80	-0.28
	A.Y.	1,152	1,200	2,352	3,994	60	3.46	1.69	1.70	-0.01
13	J.H.	1,052	1,252	2,304	1,506	75	1.43	0.65	2.10	-1.45
15	W.S.	804	1,600	2,404	1,377	66	1.71	0.57	1.85	-1.28
20	L.P.	688	960	1,648	3,400	72	4.93	2.06	2.05	+0.01
14	R.L.	1,040	1,600	2,640	2,130	67	2.04	0.80	1.90	-1.10
16	E.S.	922	1,600	2,522	2,174	71	2.35	0.86	2.00	-1.14
8	W.H.	1,186	1,600	2,786	6,703	63	5.65	2.40	1.80	+0.60
10	A.F.	677	1,250	1,927	3,580	59	5.28	1.81	1.65	+0.16
11	H.W.	1,168	1,450	2,618	2,470	73	2.11	0.94	2.05	-1.11
	A.L.	1,786	525	2,311	5,768	78	3.22	2.09	2.20	+0.29
6	H.R.	1,408	1,600	3,008	3,711	62	2.63	1.23	1.75	-0.52
	F.M.	890	900	1,790	3,143	62	3.53	1.70	1.75	-0.05
7	F.S.	1,348	750	2,098	3,950	51	2.93	1.88	1.45	+0.43
	C.W.	1,369	1,600	2,969	5,117	87	3.73	1.72	2.45	-0.73
12	D.F.	2,054	—	2,054	7,940	66	3.88	—	1.88	+2.00
9	L.W.	1,409	—	1,409	4,185	73	2.97	—	2.10	+0.87

calories per day may be utilized from the consumption of alcohol. This, however, contains no vitamin B. In alcoholics, therefore, the calorie intake increases according to the amount of liquor taken and the vitamin-B calorie ratio decreases. Table 5 indicates that all but three of the patients in this series had a diet adequate in vitamin B, if alcohol were not considered, but that when the calories obtained from alcohol were taken into consideration, 15 had an inadequate intake of the vitamin and most of the others were just over the line of calculated adequacy.

continued tobacco temporarily but resumed it after partial improvement and made a complete recovery. During the 3½ years since his hospitalization he has continued to use large amounts of tobacco and to maintain a good diet. Vision is 20/15, O.U. Two other patients (cases 14 and 22) with tobacco amblyopia were total abstainers from alcohol; both were on inadequate diets. Although polyneuritis and pellagra have occasionally occurred in association with amblyopia,<sup>8</sup> I never have seen a case of tobacco amblyopia with clinical evidence of vitamin deficiency. It is possible that because of

the generalized disturbance in metabolism a greater amount of vitamin B is required than would ordinarily be necessary.

The most likely explanation of tobacco amblyopia at this time is that it is a "toxic" action of the tobacco on malnourished cells. When vitamin B<sub>1</sub> is added, the nutrition of the damaged cells, or perhaps their axons, improves, and the injurious agent is no longer injurious. It seems likely from present evidence that people consuming, absorbing, and utilizing normal amounts of vitamin B never develop tobacco amblyopia.

Alcohol amblyopia may be merely a manifestation of a deficiency condition without any "toxic" element. One factor opposing this interpretation is that most of the affected patients do not show other clinical evidence of deficiency disease. Another is that in this country, in the author's experience, only patients who drink or smoke develop this syndrome. We would expect some patients who failed to consume, absorb, or utilize vitamin B normally to develop the condition even though they did not drink. A possible answer to the first objection is that a deficiency condition often manifests itself in different ways in different individuals; some alcoholic patients get peripheral neuritis, some get cerebral disturbances, some get "alcohol" amblyopia, some get all of these things at once. A possible answer to the second objection is that in this country, especially in the North, the great majority of patients with gross vitamin-B deficiencies are alcoholics. In the Orient, on the other hand, where vitamin-B deficiencies are usually not associated with alcoholism, the same type of amblyopia develops. It is called beriberi amblyopia and, according to the description of it by Elliott<sup>9</sup> and Ishihara,<sup>10</sup> is identical with "alcohol" amblyopia.

"Diabetic amblyopia" is a condition about which there has been some question.

The only patients with diabetes that the writer has seen develop the typical syndrome of tobacco-alcohol amblyopia did smoke or drink, at least in small amounts. However, Friedenwald<sup>11</sup> had one patient who had what might be called "diabetic amblyopia." She was a middle-aged diabetic woman who had never used tobacco nor alcohol, but she had the typical bilateral scotomas found in tobacco-alcohol amblyopia. Her condition did not improve until vitamin-B complex was administered. The recovery was then rapid and complete. This case, of course, fits in very well with the idea that the primary difficulty in such patients, whether they have diabetes, beriberi, or alcoholism, is a deficiency of an essential vitamin.

#### SUMMARY AND CONCLUSIONS

Approximately 175 patients with tobacco-alcohol amblyopia have been observed by the writer in the nine-year period 1933-1942. In the last seven years 25 of these patients have been allowed to maintain their usual intake of alcohol and tobacco under the following conditions:

(1) An initial group of 11 patients was placed on a diet adequate in all respects and supplemented with brewers' yeast.

(2) A second group of five patients was left on its usual diet and given vitamin-B complex.

(3) A third group of four hospitalized patients was placed on a diet inadequate in all known vitamins and given large amounts of vitamin-B complex.

(4) A fourth group of five hospitalized patients was placed on the same inadequate diet and given synthetic vitamin B<sub>1</sub> only.

All of the patients on these various regimes made partial or complete recoveries in spite of their continued and unabated use of tobacco and/or alcohol. The vision in 21 patients was 20/30 O.U. or better after treatment and in 14 was



20/20 or better. These results were at least as good as those obtained by the author in any previous consecutive 25 patients with this condition, including those who abstained from the use of tobacco and alcohol while under treatment.

The fact that all of the patients in the fourth group improved and one made a complete recovery is of special significance since in this group every known factor other than vitamin B<sub>1</sub> which might have caused improvement had been eliminated. In spite of this result, however, it is recommended that the whole vitamin-B complex be administered as well as thiamin alone in the treatment of these cases.

#### APPENDIX

This includes 25 case reports of patients with tobacco-alcohol amblyopia who continued their consumption of tobacco and alcohol. The onset of the amblyopia occurred within the past year in a few instances but it is significant that 16 of the 25 patients have been followed for an average of four years each and five have been observed over a period of six years or longer. The first 8 cases were previously reported in 1937.<sup>2</sup>

*Case 1.* C. S., a 28-year-old Negro woman, was first examined in the Vanderbilt Clinic in October, 1934. She had marked tremor of the tongue and fingers, and her breath had a strong alcoholic odor. The vision was 20/200 in each eye and was unimproved with glasses. The discs showed very marked temporal pallor consistent with atrophy of the papillomacular bundle, and the fields revealed depression of central vision. She had never used tobacco in any form but consumed between a pint and a quart of whisky daily. In three months vision improved to 20/70 in each eye and remained stationary. She was strongly advised to discontinue the use of alcohol, but she refused. Nine months after coming under observation she was admitted to the Institute of Ophthalmology. The discs appeared atrophic temporally. She had alcoholic gastritis, and two gastric analyses showed absence of free hydrochloric acid. During 36 days in the hospital she drank between one pint and one quart of liquor daily. (The liquor given to her and to all other pa-

tients and referred to hereafter merely as "liquor" consisted of equal parts of 95 percent ethyl alcohol and water flavored with the juices from lemon and orange peels. It had a pleasant odor and taste.) She took the prescribed diet. After this period she felt that her vision had definitely improved. I was certain that her eyes were not worse. She could read several lines lower on the test chart than on admission, but I felt that her condition should be considered unimproved. She has been followed 22 months since discharge from the hospital, and her eyes have shown no further change. The diagnosis was alcoholic amblyopia and partial optic atrophy, unimproved.

Three months after the above was written the patient returned to the Clinic. The vision was 20/50 O.U.

*Case 2.* G. J., a 31-year-old actor, a private patient of Dr. Gordon Bruce, entered the Institute of Ophthalmology on December 3, 1935. He drank about one quart of gin and smoked from one to two packages of cigarettes daily. Vision was 20/200 in each eye. Each disc was orange except temporally, where it was somewhat pale. The margins were indistinct, except temporally, and slightly elevated (less than 1D.). Elevation of the disc is unusual in this condition. The fields showed typical centrocecal scotomas. Neurologic examination, roentgenograms of the head, and the Wassermann test gave negative results. A medical consultant diagnosed alcoholic gastritis and hepatitis. In the hospital the patient took from one pint to one quart of liquor daily, smoked from one to two packages of cigarettes daily and faithfully ate what was given to him. In two weeks vision was 20/120 in the right eye and 20/50 in the left, and the margins of the disc appeared less elevated. In one month vision was 20/40 in the right eye and 20/30 in the left, and the scotomas had greatly decreased in size. The patient was discharged from the hospital on January 24, 1936, and three months later vision was 20/30 in the right eye and 20/20 in the left. He has not abstained from alcohol or tobacco, but he stated in a recent communication that his vision has remained the same.

*Case 3.* N. M., a 36-year-old janitor, drank about one quart of liquor and smoked one package of cigarettes daily. He was first seen in the Bellevue Psychiatric Hospital on December 12, 1935. He had pellagra, polyneuritis, and alcohol amblyopia. Vision was 10/200 in the right eye and 8/200 in the left. Each disc showed marked temporal pallor compatible with optic atrophy, and the fields had centrocecal scotomas. When his condition permitted he was transferred to the Institute of Ophthalmology. Retinoscopic examination indicated a large astigmatic error in the left eye, and he stated that vision had never been good in that eye.

For the first month in the hospital he was forced to abstain from all alcohol and tobacco, and there was slight improvement. Visual acuity increased from 18/200 in the right eye and 12/200 in the left eye to 20/120 in each eye with correction. He was then given from one pint to one quart of liquor daily and cigarettes. He faithfully took his diet. In one month on this regimen vision increased to 20/50 in the

ance, and the fields showed characteristic centrocecal scotomas (fig. 1). He was transferred to the Institute of Ophthalmology on May 13, 1936, and placed on the prescribed diet. He continued to smoke from 9 to 15 cigars daily and was given 6 ounces (177 c.c.) of liquor daily. Neurologic examination showed some increase in the deep reflexes on the left. An otologic check-up revealed early toxic neuritis.

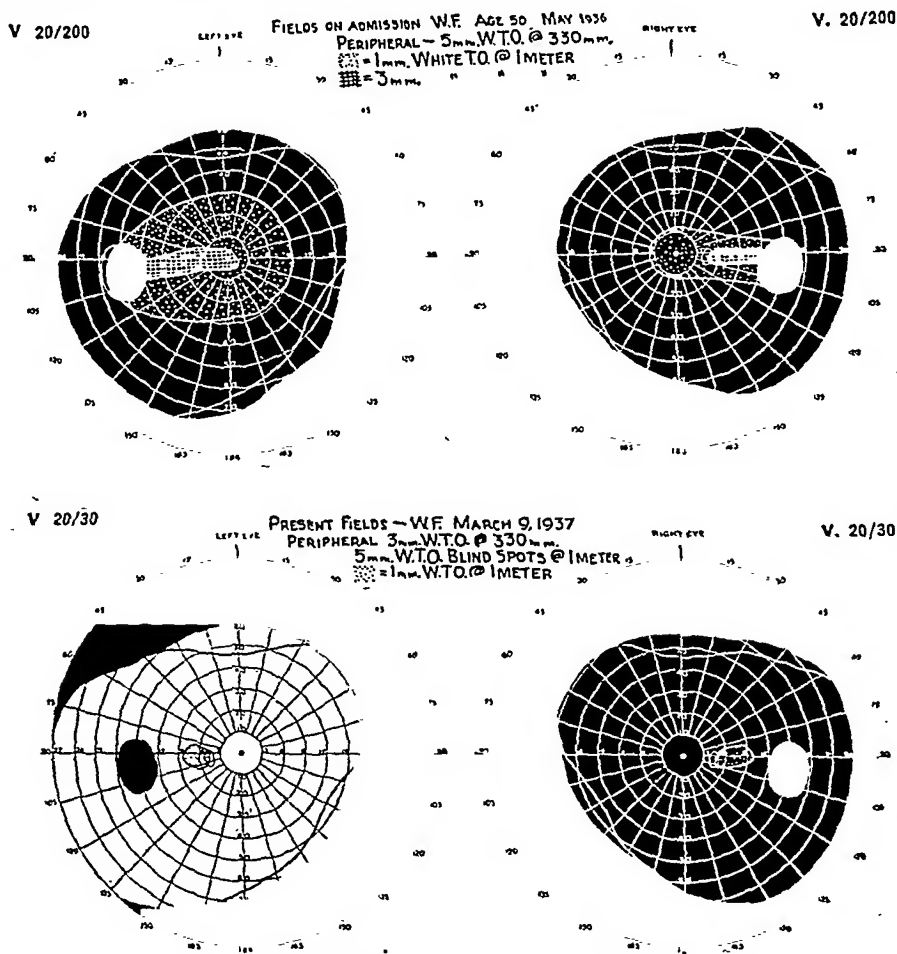


Fig. 1 (Carroll). Case 4. Fields of W. F.

right eye and to 20/120 in the left, and the fields were improved; in another five weeks, when he was discharged, vision was 20/40 in the right eye and 20/80 in the left.

*Case 4.* W. F., a 49-year-old Jewish waiter, had noticed decreased vision for four months. He had been to two ophthalmic clinics and when first seen by me was at the Neurological Institute, where he had been sent because of a suspected tumor of the brain. He smoked from 10 to 13 cigars daily and drank an average of two or three glasses of beer and an ounce (30 c.c.) of whisky daily. Vision was 20/200 in each eye; the discs were normal in appear-

ance, and the fields showed characteristic centrocecal scotomas (fig. 1). He was transferred to the Institute of Ophthalmology on May 13, 1936, and placed on the prescribed diet. He continued to smoke from 9 to 15 cigars daily and was given 6 ounces (177 c.c.) of liquor daily. Neurologic examination showed some increase in the deep reflexes on the left. An otologic check-up revealed early toxic neuritis.

The patient was last examined on June 25, 1942, six years after entering the Eye Insti-

tute. The vision was O.U. 20/30, and the field was similar to that shown above after treatment.

*Case 5.* E. F., a 32-year-old Negro postoffice clerk, had the alcoholic type of pellagra, polyneuritis, and amblyopia. When he entered the Institute of Ophthalmology on May 14, 1935, vision was 3/200 in each eye (fig. 2). He abstained from alcohol and took all the prescribed food for 35 days. Vision by then had improved

diarrhea. His vision was still excellent. He was given more yeast. Then he disappeared until December 17, 1936, when he came back so weak that he could walk only with difficulty. He had the dermatitis, stomatitis, diarrhea, and peripheral neuritis which accompany pellagra. He had continued his intake of alcohol, but instead of taking 4 tablespoonfuls of powdered brewers' yeast daily he had been using only a few tablets of powdered brewers' yeast daily.

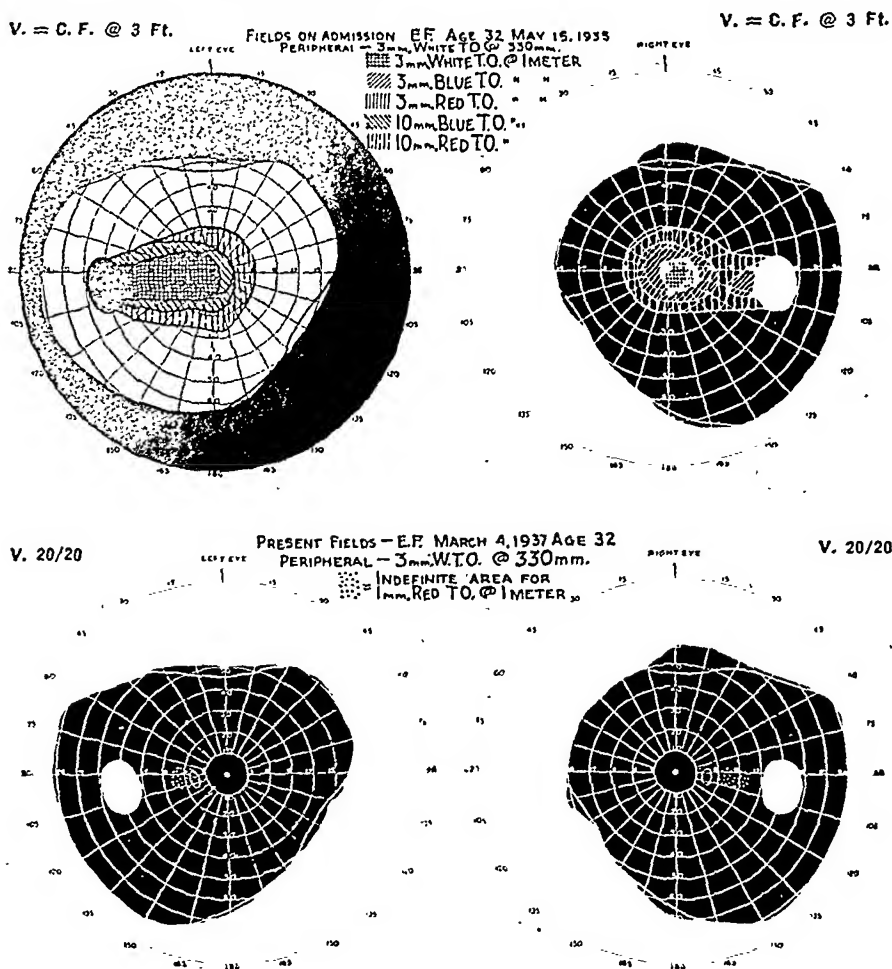


Fig. 2 (Carroll). Case 5. Fields of E. F.

to 20/40+ in each eye, and he was discharged. He immediately started to drink and smoke as much as previously but regularly took the powdered brewers' yeast and wheat germ as prescribed. Vision gradually improved to 20/20 in each eye, and the fields showed only a small indefinite scotoma between the blindspot and the fixation point. Then he stopped taking yeast but continued his usual intake of whisky (from one pint to one quart daily). In about five weeks the pellagra returned, and he came back to the clinic. He had mild typical pellagral dermatitis, pain in his legs and feet, and

Vision remained 20/20 in each eye, and there was only the same small residual scotoma between the blindspot and the fixation area in each eye (fig. 2). He was again hospitalized and given powdered brewers' yeast in doses of 2 tablespoonfuls five times daily (90 gm.), wheat germ in doses of 4 tablespoonfuls three times daily, vegex in doses of 1 teaspoonful three times daily, and 5 or 10 c.c. of liver extract intramuscularly daily. He was also given one pint of liquor daily. Gastric analysis showed lack of free hydrochloric acid. His condition again rapidly improved, and he was

discharged in four weeks free from any symptoms. Since then he had continued his usual consumption of tobacco and alcohol but has faithfully taken 2 tablespoonfuls of yeast daily. He has no symptoms.

Case 6. H. R., a 63-year-old man, was first seen in the Vanderbilt Clinic on May 29, 1935. His vision at that time was 20/200 in each eye with correction. The right eye had not had good vision since having a corneal ulcer 12 years

10 cigars daily and from 6 to 14 ounces (177 to 414 c.c.) of liquor. He took all the prescribed diet. No improvement was seen for almost a month; then it came gradually. In two months vision in the left eye had improved from 5/200 to 20/80. The opacities in the cornea and lens of the right eye appeared sufficient to explain the poor vision of 10/200 in that eye. In three months vision of the left eye was 20/60—, and on discharge from the hospital vision of the

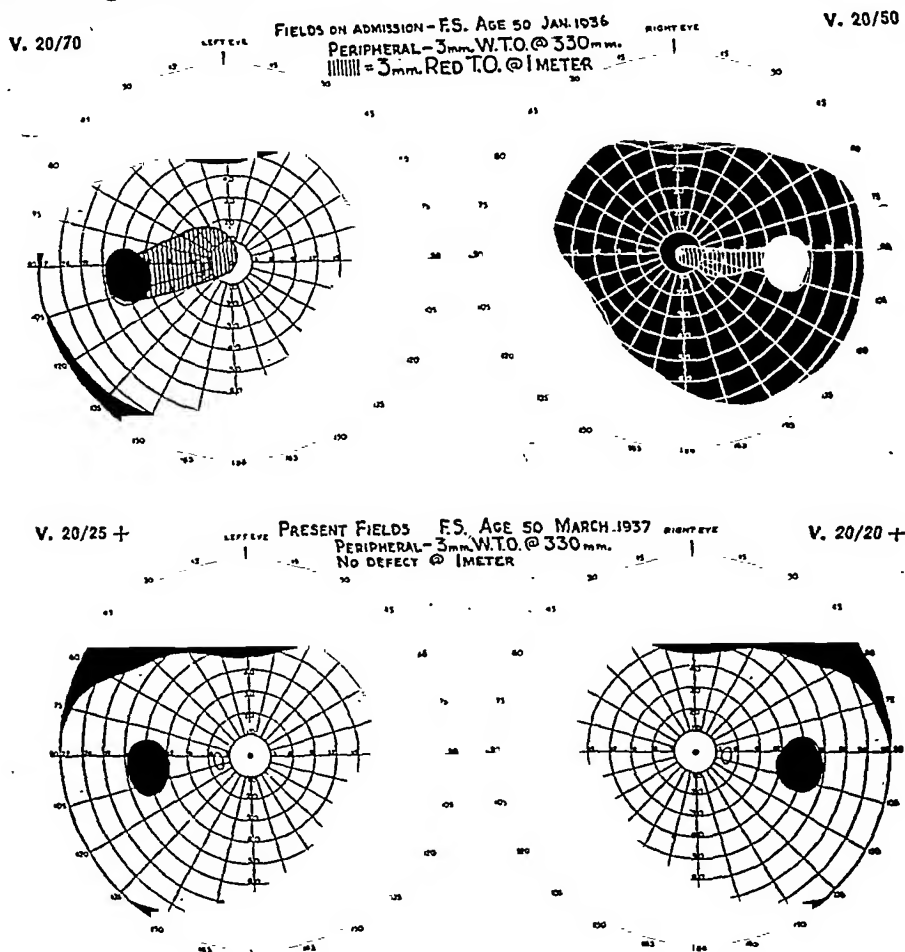


Fig. 3 (Carroll). Case 7. Fields of F. S.

previously. It showed diffuse corneal opacities and an incipient cataract. The left eye also had an incipient cataract, which was not sufficiently dense to explain the decreased vision. The discs appeared normal, and the fields showed typical centrocecal scotomas. The patient drank four glasses of beer and smoked from 10 to 12 cigars daily. He was advised to discontinue tobacco and alcohol and did so, but when I first saw him two months later, on July 26th, vision had decreased to 10/200 in the right eye and to 5/200 in the left. He was admitted to the Institute of Ophthalmology and allowed to drink and smoke as much as he wished—this was about

right eye was 10/200 and that of the left eye 20/40. There was marked decrease in the density of the scotomas. This patient remained in the hospital under close observation for a total of five months. During this time vision of the left eye, which was the only eye in which vision could be expected to improve, increased from 5/200 to 20/40. Except for one week during this period he smoked an average of 10 cigars daily and drank from 6 to 14 ounces of liquor daily. On discharge from the hospital he was advised to decrease or discontinue the use of tobacco and alcohol. It is not certain that he followed this advice. Fourteen months since dis-

charge vision of the left eye was the same—20/40+.

On March 4, 1938, vision was the same—20/40+; on January 16, 1941, it was still the same. On June 25, 1942, the patient was seen again. He had entirely disregarded his diet in the past six months. He was smoking more than ever: one pound of pipe tobacco a month plus three cigars daily. The centrocecal scotoma

one quart of wine and smoking one package of cigarettes daily. For the past several years he had noticed some abdominal discomfort, and during the past year had lost from 10 to 15 pounds (4.5 to 6.8 kg.) in weight. His appetite was poor. On January 20, 1936, he entered the Institute of Ophthalmology. He brought his own wine and cigarettes with him, and throughout his stay in the hospital he used the same

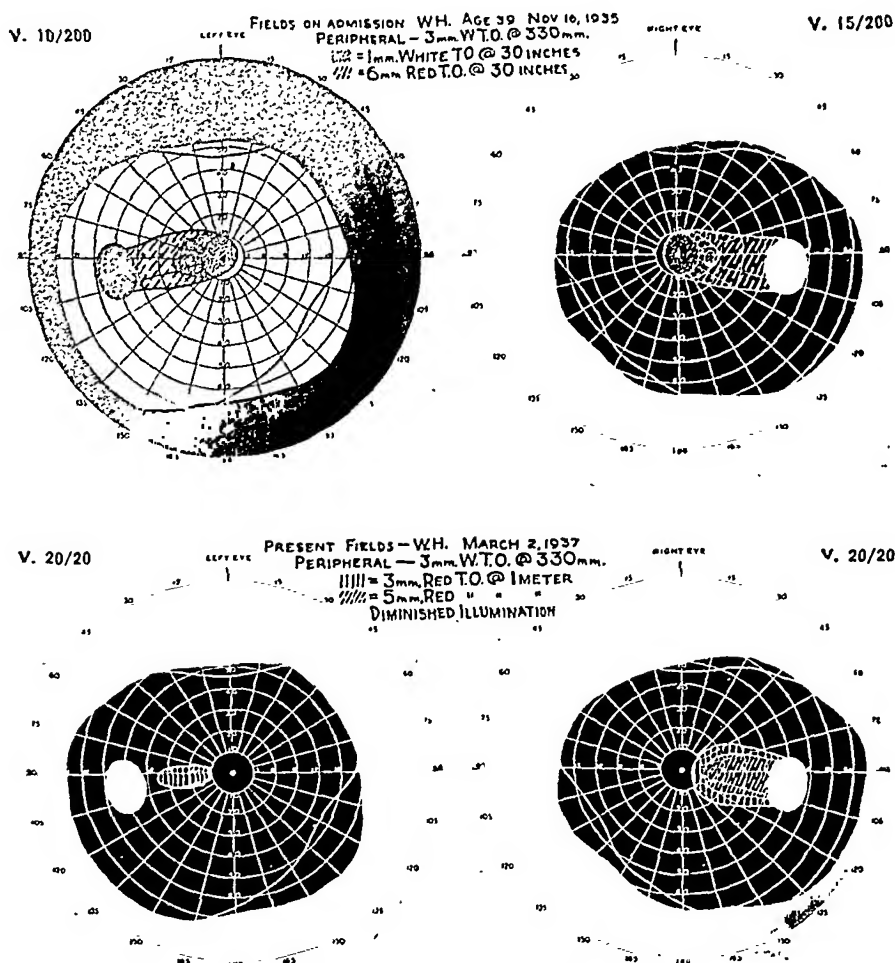


Fig. 4 (Carroll). Case 8. Fields of W. H.

in the left eye had increased in density, and the visual acuity was 20/70. The decrease in vision was due chiefly to the scotoma, although there had been an increase in the lens opacities.

Case 7. F. S., a 50-year-old unemployed Italian bank clerk, was referred to me for treatment by Dr. Charles Perera, who made the diagnosis of toxic amblyopia. Vision corrected was 20/30 in the right eye and 20/70— in the left; typical centrocecal scotomas were present (fig. 3). The discs were normal in appearance. The patient stated that his vision had been gradually decreasing for the past year. He was accustomed to drinking between one pint and

amount of wine and smoked the same number of cigarettes that he had consumed while the tobacco-alcohol amblyopia was developing. He remained in the hospital under close observation for seven weeks. He took the prescribed diet. His weight increased 15 pounds (6.8 kg.). His vision gradually improved to 20/20— in the right eye and to 20/30— in the left in 17 days, and was 20/20+ in the right eye and 20/30+ in the left when he left the hospital. Since then 14 months have passed. At no time during this long course of observation has the consumption of alcohol or tobacco ever been reduced. He has continued to take 1 or 2 tablespoonfuls of yeast

daily because I was not sure that it would be safe for him to discontinue it. Vision now is 20/20+ in the right eye and 20/25+ in the left. I am unable to plot any scotoma in either eye (fig. 3).

This patient has been seen every 1 to 2 years. His improvement has been permanent. On June 25, 1942, more than six years after his hospital admission, vision was O.U. 20/20 and no scotoma was present. He had not decreased his smoking or drinking.

Case 8. W. H., a 39-year-old Negro, was seen by me on November 8, 1935, at the Vanderbilt Clinic. He stated that his vision had been gradually decreasing for seven weeks. He drank between one pint and one quart of cheap corn whisky daily and smoked one and a half packages of cigarettes daily. Vision was 20/200 in each eye, and the fields showed centrocecal scotomas, which are always present in the eyes of persons with tobacco-alcohol amblyopia; the rest of the ocular examination gave negative results. One week later, vision had decreased to 15/200 in the right eye and to 10/200 in the left eye (fig. 4), and the patient was admitted to the Institute of Ophthalmology. Gastric analysis revealed absence of free hydrochloric acid. Throughout the period of hospitalization he smoked his usual number of cigarettes daily and was given between one pint and one quart of liquor daily. I purchased a quantity of the corn whisky he had been drinking, had it examined chemically, and then gave it to him for consumption in the hospital. Chemical analysis failed to show any appreciable quantity of any toxic substance except ordinary ethyl alcohol, and this has been the chemical finding in numerous other samples of liquor used by other

patients with this type of amblyopia. The diet which he was given was a high vitamin-B, well-balanced diet adequate in all respects and supplemented by powdered brewers' yeast in doses of 2 tablespoonfuls five times daily; vegex (a brewers'-yeast extract) in doses of 1 teaspoonful three times daily, and wheat germ (Embo) in doses of 4 tablespoonfuls three times daily. He was also given liver extract intramuscularly in doses of 5 c.c. several times weekly and cod-liver oil in doses of 1 ounce (30 c.c.) daily. This therapy will be referred to later merely as the "prescribed diet."

While the patient was on this prescribed diet and while he was having his usual intake of tobacco and alcohol his vision gradually improved in seven weeks from 15/200 in the right eye and 10/200 in the left eye to 20/25 and 20/30+, respectively. The fields of vision showed a corresponding improvement, and he was then discharged from the hospital. He was advised to decrease his consumption of alcohol because of any possible effect that such large quantities of alcohol might have on other organs of the body, but he has not followed this advice very well. He was also advised to take 2 tablespoonfuls of powdered brewers' yeast daily, and he has followed this advice somewhat better. Seventeen months have passed since his discharge from the hospital. Vision is 20/20 in each eye.

This patient returned for a check-up in July, 1942—almost seven years after the onset of the amblyopia. Vision was 20/15 in each eye, and the scotoma between the blindspot and the point of fixation was considerably smaller in size and density.

*(Part II will appear in the next issue.)*

I. METASTATIC CARCINOMA OF THE CHOROID  
II. GENERAL METASTASIS FROM A MELANOMA OF THE ABDOMINAL  
WALL, WITH PARESIS OF THE EXTERNAL-RECTUS MUSCLE  
III. RUBEOSIS IRIDIS, WITH MELANOMA OF THE CHOROID AND  
SECONDARY GLAUCOMA\*

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I. METASTATIC CARCINOMA OF THE  
CHOROID

Metastatic carcinoma of the choroid is an uncommon condition, although Bedell in a paper read before the New York Academy of Medicine in November, 1942, and as yet unpublished, was able to collect 250 cases from the literature. In this paper, which Dr. Bedell kindly permitted me to read, in the third volume of Parsons,<sup>1</sup> and in Duke-Elder's third volume,<sup>2</sup> the literature up to date may be consulted, and from these sources I have drawn for general considerations of this affliction, which my own limited experience does not supply.

The term *metastatic carcinoma of the choroid* is hardly the proper one, since all carcinoma of the choroid is metastatic. There is no epithelium in the choroid from which a primary lesion of such a nature could originate.

Metastatic carcinoma of the eye most often involves the choroid, and in the posterior segment. The reason is that the embolus enters the eye by the short posterior ciliary vessels. That it is not a more common seat of metastasis is owing to the fact that the ophthalmic artery comes off from the internal carotid almost at a right angle, and material in the blood current more readily passes on to the brain and meninges by the more direct route. Anatomic considerations determine the fact that the left eye is more often affected, although, in both of the cases which I am

reporting, it was the right eye that suffered. Females are more often affected than males, because the commonest site of the primary growth has been the female breast.

The lesion itself presents a rather characteristic appearance which is described as follows by Duke-Elder:

It is rarely circumscribed, but rather appears as a flat thickening of the choroid, usually thickest at the posterior pole and thinning off anteriorly. . . . The swelling is of a pale gray color; the surface usually displays a gray mottling, and the edges are not sharply defined. . . . Increase in growth occurs rapidly, more rapidly than in a flat melanoma. Glaucoma is late in appearing, but pain is earlier and more pronounced than in primary tumors, and frequently involves the necessity for enucleation. Retinal detachment may occur.

From various opinions expressed in the literature, the following facts seem to be true:

Carcinoma of the choroid is most common between the ages of 30 and 60 years, as would be expected. It is often bilateral, of rapid growth, rarely perforates the ball, is secondary to a previous growth elsewhere, is often accompanied by low intraocular tension, and is flat, whereas a sarcoma of the choroid is usually round and elevated. In my limited experience, the appearance suggests a lesion like Coats's disease, rather than a tumor.

That the growth assumes a flat form instead of the globular projecting form which the sarcomata take, is due to the fact that the embolus lodges in a capillary, from which it breaks through. The proliferating cells occupy lymph spaces and naturally spread in these

\* Read before the seventy-ninth annual meeting of the American Ophthalmological Society, at Hot Springs, Virginia, June, 1943.



spaces between the planes of the choroidal stroma.

Since the condition is a metastasis, removal of the eye is not necessary unless indicated by pain.

The two cases I wish to report are based on a clinical diagnosis only. In neither case was the eye removed, so that a pathologic examination was not made.

*Case 1.* Mrs. P. D., aged 59 years, was seen through the kindness of Dr. Robert Sullivan of Nashville, on December 1, 1942, in regard to the condition of her right eye. The vision in this eye had been defective for two months, and was about 1/200, excentric. She had had the right breast removed six years before, but, according to her statement, no pathologic examination was made. The operation was extensive, and she was told the trouble was malignant. The left eye was normal, vision 6/6 and presbyopic.

The right eye showed clear media and a normal disc. Beginning at the macular region, there was a yellow irregular mass, elevated 7D. The lower edge was sharply defined, and reached to the level of the disc. The elevated area extended upward in the central part of the field almost to the limit of the visible field. Transillumination did not show a shadow. Tension was normal. The field manifested a large central scotoma from the 5-degree circle above to 30 degrees in other directions. X-ray examination of the chest and extremities showed an area of destruction in the upper end of the left humerus, and in the distal end of the left clavicle, due to metastasis. There was a large amount of fluid in the left pleural cavity, and several metastatic nodules in the right lung.

The ocular lesion was regarded as metastatic carcinoma and no treatment was advised.

*Case 2.* Mrs. F. W., aged 46 years, wife of an Army officer, was seen in August, 1942, on account of a disturbance of the

vision in the right eye. She had been in different Army hospitals, and had, as the beginning of her illness, amputation of the left breast for cancer in February, 1941. In 1942 she was admitted to another Army hospital because of aphonia, and tumor masses in the supraclavicular region. No biopsy specimen was taken for fear of accelerating the pathologic process, but X-ray therapy was given, and the masses subsided. She was discharged from this hospital on July 7th, the diagnosis being "carcinoma metastatic of pelvis, right femur, vertebral column, left supraclavicular region and elsewhere, secondary to carcinoma of the left breast." I saw this patient in August, 1942, and she was readmitted to the Army hospital in September for a few days' observation. X-ray studies at this time showed further involvement of the pelvis and first lumbar vertebra.

With the right eye the patient read 6/15 and J-14, unimproved. The field was irregularly contracted, 20 degrees up, 30 degrees in, 60 degrees out, with a large blind area from the blind spot downward. The media were clear. The disc was seen with a +3.00D. lens, and was observed to be elevated in the upper inner half, but sharply defined and not elevated in the lower outer half. The vessels passed forward abruptly up and in to +11.00D. The surface of this region was yellowish white, irregular and solid looking, not the usual appearance of a detached retina. The elevated area reached down to the ascending temporal vessels, which were seen with a +3.00D. lens. There was no hemorrhage nor exudation. The upper inner quadrant was dark to transillumination. The condition was considered metastatic carcinoma, and no treatment was advised. A fundus photograph was taken, but did not show the condition. The hoarseness was considered to be due to involvement of the recurrent laryngeal

nerve, as the larynx was not involved in the tumor.

This patient died in November, 1942. The affected eye had become entirely blind.

Her husband, as stated, was an Army officer, and among those who were at Bataan. No word was received from him after the fall of the Islands until a few days after the wife's death, namely December 9th, when he was reported a prisoner of the Japanese.

## II. GENERAL METASTASIS FROM A MELANOMA OF THE ABDOMINAL WALL, WITH EXTERNAL-RECTUS PARESIS

*Case 3.* G. F., an active and busy lawyer, aged 70 years, had had repeated ocular examinations during the last 20 years, and the eyes were found to be normal except for hyperopia and presbyopia. On December 4, 1939, he came for examination, saying that the night before while driving his car, he began to see double, and this had continued.

The vision was 6/6 with glasses. There was a slight arteriosclerosis of the retinal arteries, slight posterior central lens opacities, and a few vitreous opacities. Tension and pupils were normal.

There was constant homonymous diplopia, not increased in any direction of gaze. The images were fused with a 12<sup>A</sup> prism, base out; motion was not impaired. Occlusion of one eye relieved the diplopia. There was no change in the condition till December 26th, when the patient became dizzy, and fell in his room. The following history of incidents, before and after I saw him, is pertinent to the eye symptoms.

In March, 1939, he had a pigmented mole removed from the abdominal wall by Dr. J. W. Snyder, of Miami, to whom I am indebted for the following notes:

The preoperative diagnosis was pigmented mole on the abdomen. Operation:

removal of the mole. The mole was in the pubic region, and had recently shown some soreness with slight bleeding and irritation. The inguinal glands were not palpable, but malignancy was feared.

An elliptical incision was made around the mole, at no place nearer to it than 1½ cm. The entire thickness of the skin was removed in a single flap, by means of the high frequency current. The flaps were then undercut above and below, and the skin approximated under slight tension.

The specimen was examined by Dr. Phillip Resek, of Miami, who reported as follows:

"The specimen consists of a piece of skin, measuring 7 by 3½ cm. In the middle of this piece of skin, there is an elevated, brownish-red-pigmented granularlike area, measuring about 2 cm. in diameter. Within this naevuslike formation there is a wartlike tumor, which is also brownish red in color, and measures about 1 cm. in diameter. The cut surface shows that the cutis within this pigmented area is smaller than normal and atrophic.

"Sections of the mole show the epithelium of the skin near the mole to be very pigmented within the basal cells. The epithelium covering the mole itself is very irregular, and the interpapillary connective tissue presents a large number of chromatophores and fibroblasts, loaded with pigment. The tumor itself consists of typical naevus-cell nests, of which a few show a palisadelike arrangement, occasionally seen in medullary sarcoma without pigmentation. There are also numerous mitoses present. In one edge of the tumor, the hyperkeratotic epithelium penetrates the basal membrane, and becomes rather irregular.

"Diagnosis: Pigmented mole with beginning transformation into malignancy."

The sections were also examined by Dr.

H. C. Schmeisser, of the University of Tennessee, who reported as follows:

*"Microscopic examination:* The projecting portion of the section is covered with squamous epithelium, which is not taking an active part in the pathologic process. In the corium are closely packed cells, which in areas are spindle shaped and arranged in strands. They contain mostly large, pale, elongated nuclei, frequently large and hyperchromatic, with fairly frequent mitotic figures.

"In other areas, these cells have taken on a more rounded outline, and are larger, with large, pale, round nuclei, frequently hyperchromatic—sometimes with several nuclei in the same cells. Occasionally these cells show a finely granular brownish pigment. The supporting tissue is very delicate and insignificant. This pathologic process is limited to the corium. The continuing skin around the projecting portion shows the histology of a pigmented naevus.

"Diagnosis: Melanoma of the skin of the abdomen."

It will be noted that a wide excision of the growth was made, and X-ray treatment was advised, but the advice was not followed. The wound healed without trouble. The next incident was a visit to his physician, Dr. W. C. Cheney, on the same day that he consulted me, and the following note was furnished by Dr. Cheney:

"Mr. F. came to my office on December 4, 1939. He developed a pain in the left quadrant of his abdomen on the 9th of November. The pain was then referred to the left side of chest. He had no fever. Two weeks before coming to see me, he developed a lot of gas and vomited. He took a high enema, and got relief, and took phosphosoda with good results. His blood pressure was 180/104.

"On December 26th he became dizzy and fell in his room. It was recalled that he had had a chronic suppurative otitis

media, but the ear had been dry for a number of years, and there were no signs of active trouble. X-ray examination of the head and body at that time was normal except for the skull, about which the report was as follows:

"Antero-posterior and lateral examination of the skull shows many irregular areas of bone absorption in all stages of development, scattered through the cranial bones. The process had all the essential characteristics of secondaries from a primary new growth.

"Stereoscopic X-ray study of the skull confirms the previous findings in skull. There is, however, a possibility of the skull process mentioned being primary, as a multiple myeloma."

The patient went to Florida, and the subsequent history is given in a letter from the physician who attended him there:

"On the morning of January 13th, Captain F. was seen and seemed to be a bit cloudy, although he did rouse up, smile, and answer questions with slight coaxing. His only difficulties were nausea, double vision, and a tendency to go to the left when walking. On the day before, that is, the 12th, he was at the Surf Club. The cloudiness continued during the 13th, although he was able to eat his meals and talk. At 7:30 that evening, he developed generalized convulsions, originating on the right. He was given sodium luminal by hypodermic. This failed to control the convulsions, and ether was employed by inhalation. This also failed to control them, and he was brought to the hospital.

"On arrival there, more sodium luminal was administered, and he was placed in an oxygen tent. Convulsions continued, temperature rose, and he was in a profuse perspiration. Thirty cubic centimeters of water-clear spinal fluid were removed from the spinal canal, but this did not alter the condition. Chloroform was then

used, and this, in turn, did not stop the convulsions. However, their intensity was greatly diminished by the use of sodium luminal, and on the following morning he was quiet, with an occasional tremor of the right foot. Bronchial breathing was found over the right upper lung. Anuria persisted from the 13th to the 15th, and the N.P.N. was increased to 96, with  $3\frac{1}{2}$  creatin. Blood sugar was 147, after intravenous glucose in saline had been employed.

"On the 16th, the tremor of the right hand had ceased, and urinary output had increased within the last 24 hours. The anuria occurred with the convulsions, temperature, and drenching sweats. That day, the respirations gradually became more superficial with development of pulmonary edema. Temperature at 3 p.m. was  $107^{\circ}$ , and respirations very superficial. Of course, if this man had not had the history of metastatic malignancy in this area, I would have uncovered the cortex on the left, as there seemed to be a rather definite picture of cortical irritation on the left. However, with definite evidence of malignancy, this seemed futile. Mr. F. died that day—no autopsy."

### III. RUBEOSIS IRIDIS, WITH MELANOMA OF THE CHOROID AND SECONDARY GLAUCOMA

Case 4. D. S., aged 39 years, said that the vision in the right eye had been poor for many years, and the test when taken on his present examination was 20/200 in that eye. On December 24, 1942, he got some dust in the eye from the material on which he was working in a munitions plant. This dust was composed of aluminum, iron, and other ore dust. Examination in another city at that time showed the left eye to be blind, and he was advised to have it removed as there was a probability that it contained a tumor.

He was examined a month after this

accident. The right eye was normal and hyperopic 2D. The left showed a dilated and fixed pupil—7 mm. in diameter—there were vitreous opacities and the details were very dim. The lower half of the retina was detached to the disc and in the extreme temporal field, an irregular yellowish area was seen. This part of the eye was dark on transillumination. Tension was 45 mm. Hg (Schiötz). The feature which is the occasion for presenting the history of this patient is the appearance of the iris. The narrow iris was almost covered with a net of superficial vessels, which lay on the surface of the iris, not in the stroma. In some respects it resembles rubeosis, but differs from the descriptions of rubeosis in that the vessels did not seem to be especially distributed around the pupillary margin, and the patient was not a diabetic. The widely dilated pupil may account for the vessels' apparently not being distributed near the pupillary margin.

The eye was removed. The following pathologic report was returned: "*Diagnosis:* Malignant melanoma, Callender spindle-cell, sub-type B, of the choroid. Vascularization of the anterior iris surface; glaucoma, detachment of the retina."

In regard to the iris, the report is as follows: "There is vascularization of the anterior surface of the iris. The greatest vascularity in the sections examined appears to be just peripheral to the sphincter muscle, on the side opposite the new growth."

A note was added by Colonel Ash, of the Army Medical Museum, as follows: "Although vascularization of the iris associated with glaucoma certainly makes one think first of diabetes, the condition is not absolutely confined to diabetics."

Duke-Elder has this to say about rubeosis of the iris: "The appearance of the iris is very striking, the surface being

festooned with new-formed vessels, especially near the sphincter region, when the individual branches anastomose to give the appearance of a ring."

Zeeman, in Berens's "The eye and its

diseases," mentions rubeosis iridis, and says that its "occurring in a diabetic patient does not justify the diagnosis of iritis; it may indicate venous stasis in glaucoma."

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<sup>2</sup> Duke-Elder, W. S. Textbook of ophthalmology. St. Louis, C. V. Mosby Co., 1941, v. 3, p. 1.

## SURGICAL CONTROL OF GLAUCOMA IN THE NEGRO\*

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The results of operations for glaucoma in the Negro are commonly supposed to be less successful than those of similar operations upon members of the white race. As a consequence of this belief many ophthalmic surgeons have discarded filtering operations upon the Negroes. In order to determine if such a defeatist attitude is justified, the following data from the Glaucoma Clinic of the Wilmer Institute have been assembled.

This analysis includes data from Negro patients who have been observed in the Glaucoma Clinic of the Wilmer Institute since 1934. A somewhat similar analysis of results in white patients at the Wilmer Institute was reported by Randolph and Robertson in 1942. Since there is a high percentage of Negroes in the population of Baltimore—about one third of the dispensary patients are colored—a comparable number of operations on Negro glaucoma patients are available for analysis.

An attempt was first made to classify the cases into early and late glaucoma as suggested by Reese,<sup>1</sup> and used by Randolph and Robertson<sup>2</sup> in their analysis, but

this procedure was found to be of little statistical value because the number of early cases among colored patients was very small. Over 90 percent† of the colored patients came to the Clinic with far-advanced or absolute glaucoma, and only occasionally was early glaucoma observed in the second eye. Both Reese and Randolph pointed out that late glaucoma offers a poor operative risk. Thus, immediately, one possible explanation for the poor results in the colored race is encountered.

#### MATERIAL

The material on which this analysis is based is 70 cases of early and late congestive and noncongestive glaucoma in the Negro. These cases are presented as a group. They have all been followed postoperatively for at least one year and some for as long as eight years. All operations were performed by the resident house staff, and accurate records of pre- and postoperative vision, tension, and fields are available. Operative interference was instituted on all patients who

\* From the Wilmer Ophthalmological Institute of the Johns Hopkins University and Hospital.

† Eighty-three percent of the colored cases operated upon were far-advanced glaucoma; and over 7 percent were eyes considered hopelessly lost, and no filtering operation was done.

were losing either vision or fields, or in whom the tension was elevated above a level considered safe for that particular patient. In this last category are a few cases in which the tension could be controlled by strong miotics under a rigid hospital regimen but in which it was considered unwise to permit the patient to assume such a risk at home under less favorable conditions.

Of the 70 eyes on which operations were performed, 12 had congestive glaucoma and 58 had noncongestive glaucoma. Only 12, or 17 percent, could be classed as having early glaucoma. In addition to these 70 cases of primary glaucoma there is available in the Glaucoma Clinic a second group of 25 eyes with early and late secondary glaucoma. Although of different etiology, these were also treated by filtering operations.

The success of operations was judged by the following criteria: 1. The postoperative vision must closely approximate the preoperative vision and must be maintained unless reduced by some unrelated factor. 2. The visual fields must be maintained equal to those taken preoperatively. 3. The intraocular pressure must be consistently below 25 mm. Hg (Schiotz).

The use of miotics postoperatively is not a factor in this study, since the margin of safety in the dispensary patient is greatly increased by the use of pilocarpine, and postoperatively miotics were ordered almost routinely.

Operations on eyes with normal postoperative tension in which vision was lost, without some other apparent explanation, were considered failures.

#### SURGICAL TECHNIQUE

The operative procedures employed on these eyes included corneoscleral trephining, iridencleisis, iridotasis, cyclodialysis, and iridectomy. In the last year, a number of cyclodiathermies were performed, but

since the follow-up period has not been adequate these cases are not included.

Before 1934, corneoscleral trephinations were generally preferred to iris-inclusion operations. Since that time, iris-inclusion operations have been favored. When gonioscopic studies indicated a shallow chamber with anterior synechiae, iridencleisis was the usual operation of choice, while for deep-angle glaucoma trephinations were employed.

The technique of the trephining operation varied with different operators chiefly in the degree of corneal splitting and a complete or a peripheral iridectomy. Either the hand or the Green automatic trephine<sup>3</sup> was used. No marked difference in results was apparent as a result of these variations. In all cases, a large, thick, conjunctival flap was dissected down. In some instances, the conjunctiva was first ballooned with novocaine to obtain a better plane of cleavage. At the end of the operation the eyes were usually dressed with eserine.

The technique of the iridencleisis was perhaps more uniform. A thick conjunctival flap was dissected down. This began at the insertion of the superior rectus muscle and was carried to about 2 mm. from the limbus. A keratome incision was then made, entering the anterior chamber as close to the root of the iris as possible. By depressing the posterior lip of the wound, the iris was prolapsed, was caught with iris forceps, and moved gently from side to side to break anterior synechiae. A radial cut was then made through the sphincter to the base. The pillars were spread, and the conjunctiva closed with a running black-silk suture. Atropine was used pre- and postoperatively to prevent pull on pillars.

A few iridotases are included in this series, but this procedure was used infrequently.

Iridectomies were of the classical type

TABLE 1

SEVENTY EYES IN THE NEGRO OF EARLY AND LATE PRIMARY GLAUCOMA TREATED BY FILTERING OPERATION

Success for One Year or More		Failure	
Number of Cases	Percentage	Number of Cases	Percentage
38	54.2	32	45.8

as described by von Graefe. They require no discussion, and, on the whole, the results in simple and chronic congestive glaucoma were most disheartening.

Trephining was the initial operation on 17 eyes, with success in 4 eyes, or 23 percent. An iris-inclusion operation was the first procedure on 47 eyes, with success in 24, or 51 percent. Iridectomies were done on 6 eyes, with failure in all cases (table 2).

Thus in 28 eyes, or 40 percent of the total, the glaucoma was adequately treated by one filtering operation (table 2). In the case of 42 eyes when the first operation failed, 12 patients either refused another operation or the condition of the eye was such that no further operation

TABLE 2

FORTY PERCENT OF PRIMARY GLAUCOMA IN NEGROES CONTROLLED BY ONE FILTERING OPERATION

Type of Operation	Number of Eyes	Success for One or More Years		Failure	
		Number of Eyes	Percentage	Number of Eyes	Percentage
Trephining	17	4	23	13	77
Iris inclusion	47	24	51	23	49
Iridectomy	6	0	0	6	100
TOTAL	70	28	40	42	60

Cyclodialysis was rarely used as an initial operative procedure, but was frequently used as a secondary operation when some prior operation had failed. Other than anterior hemorrhages, which in no case caused the loss of the eye, this procedure has been surprisingly free from complications. The instrument designed by Randolph,<sup>4</sup> which permits the injection of air and saline into the anterior chamber, was frequently used with good results.

### RESULTS

Of the 70 eyes with primary glaucoma subjected to one or more operative procedures, 38, or 54.28 percent (table 1), were successful during the period of observation, which was always a minimum of one year and in some cases five or more years.

was indicated. The remaining 30 eyes, not controlled by the first operation, were subjected to one or more additional operations. In 10 cases these later operations were successful, and in 20 unsuccessful (table 3). In all, 82 operations were performed on these 30 eyes. The various operations used and the results in different operations are shown in table 4. Tre-

TABLE 3

THIRTY EYES WHICH FAILED AT FIRST OPERATION WERE SUBJECTED TO SUBSEQUENT OPERATIVE PROCEDURES

Number of Eyes	Success for One or More Years		Failure	
	Number	Percentage	Number	Percentage
30	10	33	20	67



TABLE 4  
EIGHTY-TWO OPERATIONS PERFORMED ON 30 EYES  
NOT CONTROLLED BY ONE FILTERING  
OPERATION

Number and Type of Operations Performed	Success for One of More Years	Failure
31 trephining	5	26
23 cyclodialyses	4	19
20 iris inclusions	0	20
5 iridectomies	0	5
2 Lagrange	1	1
1 Seton operation	0	1
82 TOTAL OPERATIONS	10 (12 percent)	72 (88 percent)

phining and cyclodialysis are the operations of choice after one operative failure has been encountered. In the 10 eyes finally successfully controlled, an average of 3 operations per eye was necessary. In the 20 eyes unsuccessfully operated on the glaucoma was not controlled in spite of 52 various operative procedures. Eighty-eight percent of operative failure

*per se* was thus encountered in this group. This figure obscures the fact that 33 percent of eyes not successfully controlled by one operation could be finally controlled, although an average of 3 operations per eye was necessary. It seems probable that this high percentage of failure of secondary operations, together with the fact that glaucoma in the Negro has usually progressed to the late stage, is the explanation for the general impression that operative interference in the Negro is doomed to failure.

The length of time the successfully operated cases have been followed in the Glaucoma Clinic is shown in table 5. Table 6 likewise shows when the operative procedure failed during the period of observation. Only four cases failed after three years and three of these were controlled by a second operative procedure and are still under observation.

In the second group, consisting of 25 cases of secondary glaucoma, the same

TABLE 5  
PERIOD OF OBSERVATION OF 38 EYES SUCCESSFULLY OPERATED ON

Type of Operation	Number of Eyes	One Year	Two Years	Three Years	Four Years	Five Years
	Total	Number of Eyes	Number of Eyes	Number of Eyes	Number of Eyes	Number of Eyes
Trephining	9	5	2		1	1
Iris inclusion	24	6	4	8	2	4
Cyclodialysis	4	1	2			1
Lagrange	1		1			
TOTAL	38	12	9	8	3	6

TABLE 6  
TIME OPERATIVE FAILURE WAS NOTED IN 42 CASES OF PRIMARY GLAUCOMA

Type of Operation	Number of Eyes	One Month	Six Months	One Year	Three Years	Four-Five Years
Trephining	13	10	1	1		1
Iris inclusion	23	9	10	1	1	2
Iridectomies	6	4	1	1		
TOTAL	42	23	12	3	1	3

criteria for success and failure were employed. Preoperatively all cases were uncontrolled by the usual supportive treatment. Operative success was 44 percent (table 7). The initial operation was successful in 9 eyes, or 36 percent. In 2 of the 16 eyes not controlled by one operative procedure further operation was successful.

The type of operation used as an initial procedure and the percentage of success are shown in table 8. As in primary glaucoma, iridencleisis gave better results. In 9 of the 16 eyes, when the first operation failed, later operations—6 trephining, 3 cyclodialyses, and 2 iris-inclusion operations—were failures in all except 2 instances, both trephining operations.

The length of time that the cases were followed is shown in table 9.

The periods of time in which failure was noted in 16 eyes following the first operation are shown in table 10. In this group, 87 percent of the failures were noted in the first 6 months.

The complications which resulted in

TABLE 7  
OPERATIVE SUCCESS IN 25 CASES OF  
SECONDARY GLAUCOMA

Success		Failure	
Number	Percentage	Number	Percentage
11	44	14	56

operative failure in both iris-inclusion operations and trephinings for either primary and secondary glaucoma are shown in table 11. In the iridencleisis operation, there was one case of sympathetic ophthalmia, both eyes having been subjected to operation, and both eyes were lost. The other operative complications noted did not result in the loss of the eyes, although the immediate operative results were unsuccessful. It is notable that in eight cases of anterior-chamber hemorrhages following iridencleises, operative failure resulted in only two cases.

The complications incident to trephining operations were more severe. In the three instances of prolapse of the ciliary body, the eye in only one case was saved

TABLE 8  
THIRTY-SIX PERCENT SECONDARY GLAUCOMA CONTROLLED BY ONE FILTERING OPERATION

Type of Operation	Number of Eyes	Success		Failure	
		Number	Percentage	Number	Percentage
Trephinings	5	1	20	4	80
Iris inclusions	13	7	54	6	46
Iridectomies	6	1	16	5	84
Cyclodialysis	1			1	100
TOTAL	25	9	36	16	64

TABLE 9  
TIME OF OBSERVATION OF 11 SUCCESSFUL OPERATIVE CASES OF SECONDARY GLAUCOMA

Type of Operation	Number of Eyes	One Year	Two Years	Three Years	Four Years	Five or More Years
Trephining	3		2			1
Iris inclusion	7	2	1	1		3
Iridectomy	1		1			
TOTAL	11	2	4	1		4

TABLE 10  
TIME OPERATIVE FAILURE WAS NOTED IN 16 EYES WITH SECONDARY GLAUCOMA

Type of Operation	One Month	Six Months	One Year	Three Years	Five Years
Trephining	2	1		1	
Iris inclusion	5			1	
Iridectomy	5				
Cyclodialysis	1				
TOTAL	13	1		2	

and useful vision retained. Anterior-chamber hemorrhages were encountered in five eyes with operative failure in three.

No case of late infection of the trephining bleb was encountered.

#### IRRADIATION

One of the most frequent causes of operative failure in filtering operations has been the obliteration of the filtering bleb by the scar-tissue formation. This appeared especially true in the Negro, who is subject to keloid formation. It therefore appeared quite logical to attempt to prevent such secondary cicatricial scarring by postoperative irradiation of the filtering bleb. To this end, irradiation with the beta rays of radon was employed, with the use of the convenient applicator designed by Dr. Curtis F. Burnam,<sup>5</sup> which has been used for other irradiation purposes in the Wilmer Institute since 1934.

This postoperative treatment of the bleb in glaucoma cases is based on the well-substantiated experimental evidence<sup>6,7</sup> that fibroblastic activity is greatly retarded by irradiation.

In this series 11 eyes in Negroes were treated postoperatively with such beta irradiation. The results are shown in table 12. In 8 of these cases, the results were successful, and in 3 unsuccessful, although in none of the 3 failures was a postoperative tension greater than 35 mm. Hg (Schiötz) ever noted.

Although this series is too small for statistical significance, the results are encouraging. Reactions should be avoided. From experimental evidence on fibroblastic activity, probably the second, fifth, and twelfth postoperative days are the most favorable times for treatment. The radon applicator used in this Clinic is most convenient, but any radium appli-

TABLE 11  
COMPLICATIONS ENCOUNTERED IN OPERATIONS ON 70 EYES OF CONGESTIVE AND NONCONGESTIVE AND 25 EYES WITH SECONDARY GLAUCOMA

Complications	Types of Operations			
	Iris Inclusions		Trephinings	
	Operation Failed	Eyes Lost	Operation Failed	Eyes Lost
Sympathetic ophthalmia		2		
Prolapse of ciliary body	1		1	Two eyes enucleated
Prolapse of iris	1		1	
Intraocular hemorrhage	2			Two eyes enucleated
Dislocated lens				One eye enucleated
Loss of vitreous			1	
Anterior-chamber hemorrhage	2		3	

cator for beta irradiation could be used. A total dosage between 16 and 20 gram seconds is probably sufficient.

COMPARISON OF OPERATIVE RESULTS IN CAUCASIANS IN THE WILMER INSTITUTE, 1934-1942 (REPORTED BY RANDOLPH AND ROBERTSON, 1942) AND RESULTS IN NEGROES OVER A SIMILAR PERIOD

In 1942, Randolph and Robertson pre-

cases, showed 54.2 percent success. This compares favorably with results in the white patients.

In Randolph's series, trephining and iridencleisis were almost on a par. In the colored cases, iridencleisis was a far more successful operation as an initial operative procedure, but trephining or cyclodialysis gave better results after one prior operative failure (see tables 2 and 4).

TABLE 12  
ELEVEN EYES TREATED POSTOPERATIVELY WITH BETA IRRADIATION

Case Name	Type of Glaucoma	Type of Operation	Postoperative Day of Irradiation	Total Dose gram seconds	Result	Time Followed years
1. A.P.	Early noncongestive	Iridencleisis	11, 18	33	Success	7
2. B.D.	Late noncongestive	Iridencleisis	4	16	Failure	5
3. S.S.	Late noncongestive	Iridencleisis	7, 14, 30	Treated at Kelly's Hosp. 6.7	Macular lesion? Failure	8
4. S.C.	Late noncongestive	Iridencleisis	2		Success	1 yr. and 10 months
5. S.L.	R.E. Late noncongestive	Iridencleisis	7, 14, 21	20.5	Success	3
	L.E. Late noncongestive	Iridencleisis	7, 14, 21	20.9	Success	1
6. J.P.	R.E. Late noncongestive	Iridencleisis	5, 12, 19	18.0	Success	1
	L.E. Late noncongestive	Iridencleisis	5, 12	13.1	Success	1
7. J.R.	Late congestive	Multiple operations Last, trephining	4, 11	16	Failure	2½
8. J.S.	Late congestive	Multiple operations Last, trephining	2	6.3	Success	2
9. G.C.	Late noncongestive	Multiple operations Last, Lagrange	2, 9, 16	12.5	Success	2

sented the operative results in 117 eyes with congestive and noncongestive glaucoma from the records of the Glaucoma Clinic of the Wilmer Institute. Fifty-six eyes were classed as presenting early glaucoma and 61 as late glaucoma. Randolph and Robertson emphasized the point that in the early group, trephining was successful in 79.3 percent and iridencleisis in 85.4 percent of the cases, but in the late group both trephining and iridencleisis gave only 37 percent success. The type of operation was immaterial, but the time of operation was all-important.

The percentage of success in 117 Caucasians when not divided into early and late groups is approximately 59 percent. The Negro cases here reported, which were not classed as early and late glaucoma because of the small number of early

#### CONCLUSIONS

1. Primary glaucoma in the Negro was controlled in 54.2 percent of the cases by the filtering operation.

Secondary glaucoma was controlled in only 44 percent of the cases by the filtering operation.

2. Iridencleisis is superior to trephining as an initial operative procedure and the complications are less severe.

3. Trephining or cyclodialysis is the operation of choice as a second operative procedure after one operative failure.

4. When operative failure occurred, it was noted within the first six months in over 85 percent of the cases.

5. Postoperative beta irradiation of the blebs in filtering operations give encouraging results and is worthy of further trial.

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## A REPORT ON A FAMILY WITH ECTOPIC LENSES\*

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In recent years there have appeared numerous reports upon cases of ectopic lenses. Many of these have been associated with arachnoidactyly. One of the most complete reports is that of Burch<sup>1</sup> in 1936. There have been reports of several in one family, such as Lloyd's,<sup>2</sup> whose family of six showed that the mother and four children had this condition. The family I wish to place on record presents, so far as I can find, the largest incidence of this condition. There are 11 children in the family 8 of whom have misplaced lenses and a ninth has a small congenital cataract. No familial history could be elicited concerning the ancestors. The father died before an ophthalmologic examination could be arranged; however, there was no history of poor vision. The mother had entirely normal eyes.

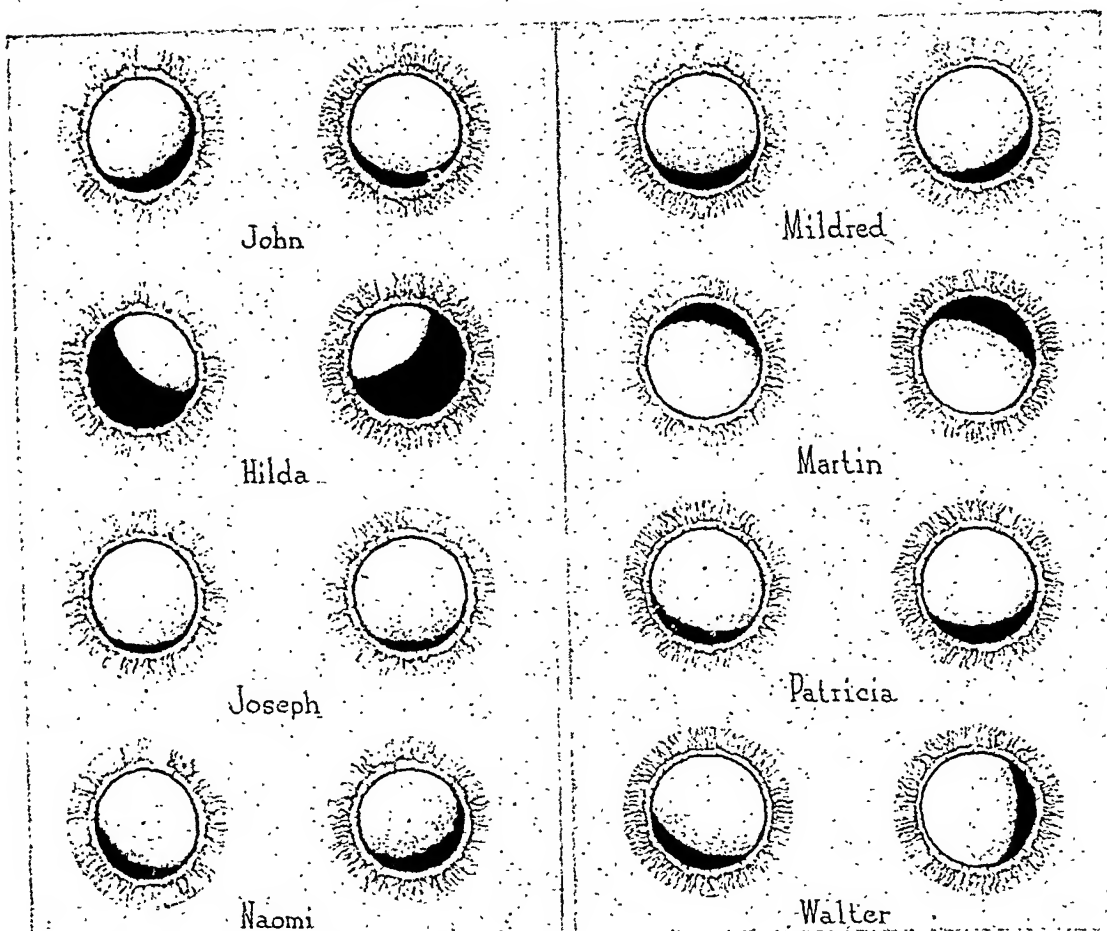
In this family all the lenses were misplaced or ectopic and none were dislocated. By that is meant that the zonular fibers were still present on the side farthest removed from the ciliary processes, and the lens was firmly fixed in its ab-

normal position. Several in the group showed some evidence of arachnoidactyly in the elongation of the fingers and toes; none, however, showed any signs of a heart murmur either systolic or presystolic.

On account of the tendency of this condition to be transmitted, as shown in Morton's<sup>3</sup> cases, where it occurred in 5 succeeding generations in 11 individuals, and very recently in those reported by Falls and Cotterman,<sup>4</sup> where in 5 generations 25 individuals were affected, although in some the diagnosis was not confirmed by examination (the largest number involved in one family was three), I advised the individuals of this group as they arrived at maturity to guard against pregnancy or having a family. However, the advice was not taken seriously, since both Joseph and Naomi have married and both produced offspring with normal eyes. Frances, who has a congenital cataract, has four children, one of whom is said to be deaf, but all have normally placed lenses. Elizabeth, the normal girl, has two sons who do not have misplaced lenses.

As is seen by the illustration nearly all the affected children had lenses misplaced

\* From the Wilmer Ophthalmological Institute of the Johns Hopkins Hospital.



upward and for the most part slightly inward, although in Martin's case they were misplaced downward. All accepted a minus glass except Patricia, who took a plus one, even when the rays passed through the lens.

A brief eye summary of the findings in all the children's eyes follows:

1. John, aged 30 years. Vision O.D., with a  $-20D.$  sph. = 13/200; O.S., with a  $-14D.$  sph. = 5/200. The left eye turns in slightly. Both lenses are misplaced.

2. Elizabeth, aged 26 years, has normal eyes. She is married and has two children, who are said to have normal eyes.

3. Hilda is 25 years old. Vision O.D., with a  $-10D.$  sph. = 20/200; O.S., with a  $-10D.$  sph. = 20/200. She has the most extensive displacement of the lenses in all the family.

4. Joseph, aged 23 years. Vision O.D.,

with a  $+0.75D.$  sph.  $\approx -1.75D.$  cyl. ax.  $170^\circ$  = 20/30; O.S., with a  $-4.50D.$  cyl. ax.  $180^\circ$  = 20/40. Both lenses are ectopic. He has been drafted into the Army; has one child, a girl, with no ectopia.

5. Frances, aged 21 years, has a small congenital lenticular opacity in the left eye at the posterior pole. She is married and has four children, one of whom is deaf, but all seem to have normal eyes.

6. Naomi is 18 years old. Vision O.D., with a  $-14D.$  sph.  $\approx -2D.$  cyl. ax.  $60^\circ$  = 20/100; O.S., with a  $-13D.$  sph.  $\approx -1D.$  cyl. ax.  $130^\circ$  = 20/100. Both lenses are ectopic. She has one child, a girl, who apparently has no ectopia.

7. Mildred, aged 15 years. Vision O.D., with a  $-12D.$  sph.  $\approx -3D.$  cyl. ax.  $180^\circ$  = 20/50; O.S., with a  $-8D.$  sph.  $\approx -5D.$  cyl. ax.  $180^\circ$  = 20/50. Both lenses are misplaced.

8. Martin, aged 13 years. Vision O.D., with a  $-15D.$  sph. = 20/200; O.S., with a  $-15D.$  sph. = 20/200. Both lenses are displaced downward.

9. Patricia, aged 11 years. Vision O.D., with a  $+5.50D.$  sph. = 20/100; O.S., with a  $+5.50D.$  sph. = 20/100. Both lenses are ectopic.

10. Walter, aged nine years. Vision O.D., with a  $-4.75D.$  sph. = 2/200; O.S., with a  $-4.75D.$  sph. =  $-3.25D.$

cyl. ax.  $180^\circ$  = 20/200. Both lenses are misplaced.

11. Jerome, aged eight years, has normal eyes as to ectopia.

While it would seem that in the case of Hilda an extraction or needling operation is indicated and, in fact, has been advised, the patient objects, and since prognosis is not good the procedure has not been urged. It will be interesting to watch for the condition in further descendants.

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### A SIMPLE TEST FOR BINOCULAR FIXATION

CLINICAL APPLICATION USEFUL IN THE APPRAISAL OF OCULAR DOMINANCE,  
AMBLYOPIA EX ANOPSIA, MINIMAL STRABISMUS, AND MALINGERING

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The refractionist in the Armed Forces sees cases of functionally poor vision whose total is out of all proportion to the number seen in civilian practice. This disproportion is due to the fact that every individual in the service is examined for visual acuity. Consequently, many of these, who under ordinary circumstances would never seek ocular advice, are concentrated in the eye clinics of the Medical Corps.

Needless to say, such cases take considerable time for evaluation and classification, especially since malingering and hysteria are so prevalent under circumstances of war-time anxiety. In the absence of demonstrable pathologic change or evidence of strabismus, the conscientious examiner struggles over and over again to ascertain whether the vision is as incorrectible as the patient claims. A simple test that could be completed in a

few minutes, definitely proving in such cases that the patient pays attention primarily to the image in only one eye, would corroborate a diagnosis of amblyopia ex anopsia. Thus a basis for one type of functionally poor vision would be established, a diagnosis of amblyopia ex anopsia being inferred. The examiner would then be relieved of doubt as to the completeness of his examination and refraction and the feeling that these should be repeated. Many cases of amblyopia ex anopsia unassociated with demonstrable strabismus, and likewise many cases of minimal strabismus not readily recognized as such, would be uncovered by such a test. In these conditions convergence may be present, and the most meticulously performed cover test may fail to reveal any movement of the eyes suggesting a minimum strabismus, for the reason that the amblyopic eye makes no attempt to fixate.



Frequently the scotomatous macular area in this eye is held in line with the visual axis of the sighting eye so that observation of the position of the corneal reflexes as recommended by Krimsky<sup>1</sup> does not contribute to the differential diagnosis. Also Krimsky's method would not be helpful in cases in which the angle gamma is different in the two eyes, both of which are actually fixating.

The test is simply a clinical elaboration of a well-known observation that by placing a small prism before one eye disjunctive movement of the eyes is elicited if fusion is present and conjugate movement if fusion is absent. It determines absence of binocular fixation, or suppression of one eye and dominance of the other, similarly to Verhoeff's image jump test (binocular phi phenomena<sup>2</sup>). This aspect of the test has the advantage of depending on an objective measurement (movement of the eyes) rather than a subjective sensation (movement of the image) and hence is easier to administer and requires less explanation. In addition, the subjective response of diplopia and movement of the images quantitates to a degree the extent to which the brain pays attention to the image of one eye over that of the other. Of course, from such a test one could not infer amblyopia ex anopsia in obvious strabismus patients, as these patients would always give an abnormal response which would be the same whether amblyopia existed or not.

#### PERFORMANCE OF THE TEST

The patient is asked to fixate a small muscle light 20 feet distant, in a dimly lighted room, and a 4-diopter prism is moved back and forth in front of first one eye and then the other, all four positions of the prism being used, that is, base in, out, up, and down. The prism is moved with a snap so as to cover and uncover the eye at about two-second intervals, and the

patient is asked what he sees. At the same time both eyes are observed carefully, particularly the eye not covered by the prism.

#### NORMAL RESPONSE

If normal binocular vision with fusion is present, the patient will say that he sees two lights with the prism in any position, as the time interval is insufficient to allow him to fuse them into one. The new light is recognized as the one that is moving and is projected to right or left, up or down, depending on the position of the apex of the prism. It will be noted that neither eye moves when this rapid movement of the prism is made. If the prism remains in place the eye under the prism moves toward the apex, whereas the opposite eye, which is fixating the light, tends to remain stationary (disjunctive movement of the eyes to fuse). Occasionally, there will be a slight wavering movement of the opposite eye as the brain may pay attention to the second image and the opposite eye moves conjugately. This movement can, however, be distinguished readily from that which occurs when the eye is inhibited to a degree or is not fixating, as would be the case in amblyopia ex anopsia or strabismus. The normal individual can easily distinguish the new light from the original, and he is simply asked to keep his attention on the original light, in which case his eyes will remain stationary.

The prism is now moved back and forth over the opposite eye and the patient is again asked what he sees and the eyes are observed. If normal binocular vision is present, the same response will be obtained for either eye.

#### ABNORMAL RESPONSE

In cases when the image from one eye is completely ignored, or partially inhibited, as in amblyopia ex anopsia even

of the slightest degree, or the eye is not sighting, as in strabismus, the response of the patient as to the presence of diplopia plus the observation of the movement of the eyes is quite characteristic. When the prism is placed over the good or sighting eye, the patient will report that he sees one light moving back and forth in unison with the movement of the prism, in contrast to the diplopia reported in the normal; and this eye will be seen to move immediately toward the apex of the prism, and the amblyopic or nonsighting eye will move in the same direction, at the same time, and to the same degree (conjugate movement). It makes no difference in which of the four positions the prism is placed over the eye.

Now when the prism is placed over the amblyopic eye there will be no movement of this eye, as it is not fixating, and the opposite eye, which is fixating, will not move. The patient may or may not say that he sees double depending on the size and degree of the retinal scotoma or inhibition area present in this eye. That is, if the new image formed by the prism falls on a scotomatous area the patient will not see it, whereas if it falls on an area only slightly inhibited, the sudden stimulus with the prism may so increase the attention value that the inhibition is temporarily overcome and the patient sees the second light projected normally or abnormally, depending upon whether or not abnormal retinal correspondence exists.

It will be noted that cases of amblyopia ex anopsia and strabismus fall into definite groups relative to the ability of the subject to see diplopia with the prism over the nonfixating eye, when the above method is used. If an organic lesion is present, as a spot of choroiditis in the macular region, diplopia will not be seen unless the prism used is strong enough to throw the image on the normal retina. Using prisms

of different strengths one can readily determine the size of the scotoma by this procedure. If the scotoma is only functional, it varies in degree in different cases of amblyopia and squint. For instance, certain squinters have a central scotoma in the macular region, whereas others have a marked area of suppression or scotoma at the point on the retina being stimulated in the squinting eye (the angle of squint). In the former cases the patient may say he sees double when the prism is placed so as to throw the image away from the macula, whereas he may see singly when the prism throws the image toward the macula. The reverse is true when the scotoma is at the angle of squint. In some cases the entire area involved in the angle of the strabismus is so inhibited that no diplopia will be seen no matter which way the prism is placed, whereas in others the inhibition is so slight that diplopia may be elicited with the prism in all positions. Usually, in cases of horizontal strabismus, diplopia can be elicited readily when the prism is placed vertically, but only poorly when placed horizontally; whereas in cases of vertical strabismus, diplopia will be poorly elicited in the vertical meridian, as this area of the retina is inhibited. Frequently, a vertical strabismus can be suspected on this basis, and the cover test, with the eyes turned to right or left, may demonstrate a previously unsuspected vertical squint.

In simple amblyopia ex anopsia, without apparent squint, the ease with which diplopia can be elicited with a prism over the amblyopic eye will depend upon whether or not a previous squint has existed. In the average case one will find that diplopia can be elicited with the prism in some but not in all positions. However, it is to be noted that placing the prism over the sighting eye does not elicit diplopia but instead the response that the image moves back and forth. On rare oc-

casions, if the patient is unusually observant and the degree of amblyopia or inhibition very slight, the patient may note diplopia even when a prism is over the sighting eye; but in such cases the patient states that the original light moves in the direction of the apex and the new light appears in the direction of the base, the reverse of that seen in the normal. In other words, the patient is paying attention primarily to the original light which he sees move toward the apex, and as this eye moves the image from the amblyopic eye becomes apparent, the movement of this image lagging behind the original and consequently appearing in the direction of the base. In such cases, which are rare, one need not depend on the subjective findings, as the conjugate movement of the amblyopic eye is so characteristic as to distinguish the condition from normal (see case 4).

Since the degree of amblyopia is only relative it is best to perform the test under conditions that tend not to overcome the inhibition. For this reason, a dimly lighted rather than a dark room is preferable, for in the dark the stimulus from the second image is greater and therefore more noticeable, making the contrast from the normal situation less apparent. Likewise, the size of the prism is important. It is best to use a prism within the fusion range of the normal eye and yet strong enough to cause diplopia and noticeable movement of the eyes if moved rapidly enough not to allow fusion to take place. A 4-diopter prism meets these qualifications, as one can readily demonstrate by experimenting on his own eyes. Diplopia will be elicited readily and yet it can be overcome by fusion; and at the same time movement of the eyes can be easily seen. The conjugate movement, so characteristic of amblyopia, can be demonstrated by covering one eye and noticing how it moves under cover while the opposite eye

moves to fixate when a prism is moved back and forth before it.

Prisms of other strengths can be used. For instance, normal individuals readily admit diplopia with a 2-diopter prism, but movement of the eyes of this degree is difficult to observe. However, if amblyopia with an extremely small scotoma is suspected, this strength prism could be used, the normal admitting diplopia readily, whereas the person with amblyopia would not. A larger prism, as 6 to 10 diopters, could be used to measure gross scotomata, but with prisms of such strength even normal binocular mechanism is disrupted to the extent that the eyes move, thus confusing the test if a gross scotoma were not present.

In actual practice, and after only slight experience, one can do the test very quickly, using only one or two positions of the prism in most instances to ascertain that the vision in one eye is being utilized or suppressed. Thus is determined the fact that the eyes behave either normally or abnormally, and the inference made therefrom that the poor vision acknowledged by the patient is either the result of hysteria or malingering, or that a basis for amblyopia ex anopsia of some degree exists.

Five typical cases are appended: Case 1—amblyopia ex anopsia with moderate inhibition, inhibition in the vertical meridian only; palsy of the inferior oblique muscle. Case 2—amblyopia ex anopsia with moderate inhibition. Case 3—amblyopia ex anopsia with marked inhibition. Case 4—amblyopia ex anopsia with minimum inhibition. Case 5—reduced vision in one eye without evidence of amblyopia ex anopsia.

#### SUMMARY

A brief summary of the results of the test is simply that a prism, moved rapidly back and forth before an eye which is con-

tributing to normal binocular vision and fusion, causes diplopia to be noted and produces little or no movement of either eye. The same is true over whichever eye the prism is placed.

In amblyopia and strabismus, the prism moved in front of the sighting eye induces no diplopia but instead a to-and-fro movement of the image, and conjugate movement of the eyes; whereas a prism before the amblyopic or nonsighting eye may or may not induce diplopia, and results in little or no movement of either eye.

The above test, requiring no special equipment, provides a quick and decisive method for determining that binocular fixation and fusion are present or that suppression of one eye and dominance of the other exist, findings helpful in the differential diagnosis of amblyopia ex anopsia, minimum strabismus, malingering, or hysteria. In addition it indicates the degree of inhibition existing in amblyopia and strabismus, an estimation which might be of prognostic importance if the good eye were injured.

#### ILLUSTRATIVE CASES

CASE 1. J. M., presented a case of amblyopia ex anopsia with moderate inhibition, the inhibition being in the vertical meridians only; palsy of the inferior oblique muscle. O.S. was partially amblyopic; vision 20/100 with and without glasses; refraction was +2.00D. sph.  $\approx$  -1.00D cyl. ax. 85°. O.D., vision 20/25; with +1.00D. sph.  $\approx$  -.75D. cyl. ax. 105°, 20/20. In the primary position the patient's eyes fixated binocularly and converged normally. He was unable to discern depth with the new Verhoeff apparatus.<sup>3</sup>

*Results of prism test.* 1. When the prism was moved before sighting eye (O.D.), the patient saw no diplopia with the prism in any position, but reported that the image moved to and fro as the

prism was moved back and forth in front of the eye. The observer noted that both eyes moved back and forth conjugately with the movement of the prism. 2. When the prism moved before the amblyopic eye (O.S.), the patient saw diplopia with the prism in the horizontal positions, the new image being in the direction of the apex of the prism; but with the prism in the vertical position the patient saw no diplopia. The observer noted no movement of the eyes when the prism was placed in any direction. Because of this finding the cover test was carefully repeated and it was noted that there was definite underaction of the left inferior oblique when the eyes were turned to the right. With the eyes turned to the right the left eye was slightly down, and when the patient attempted to look up and to the right, he was unable to elevate his left eye beyond the horizontal plane.

CASE 2. A. K., presented a case of amblyopia ex anopsia with moderate inhibition. O.D. was amblyopic, vision 20/200 uncorrected; with +2.00D. sph.  $\approx$  -2.00D. cyl. ax. 45°, 20/70. O.S., emmetropic, 20/15. There was no history of strabismus; the patient fixated binocularly; the eyes converged well; there was no depth perception as judged by the new Verhoeff apparatus.

*Results of prism test.* When the prism was moved over the sighting eye (O.S.), the patient saw no diplopia with the prism in any direction, but instead reported a single image moving in the direction of the apex of the prism. The observer noted that both eyes moved in the direction of the apex. 2. When the prism was moved over the amblyopic eye (O.D.) the patient saw a new image in the direction of the apex in all fields and the observer noted no movement of the eyes.

CASE 3. G. S., presented a case of amblyopia ex anopsia with marked inhibition. O.D., vision was 20/20 and with

+1.50D. sph.  $\Rightarrow$  - .50D. cyl. ax.  $170^{\circ}$ , 20/20. O.S. was amblyopic; vision 10/200, and with +3.50D. sph.  $\Rightarrow$  -1.00D. cyl. ax.  $15^{\circ}$ , 10/200. The patient had a history of internal strabismus in childhood. His eyes were straight cosmetically at the time of this examination, and no movement of the eyes was noted on making the cover test. However, careful observation of the corneal reflexes showed eccentric fixation O.S. of about 5 prism diopters. Convergence was normal.

*Results of prism test.* 1. When the prism was moved before the sighting eye (O.D.), the patient saw the image move in the direction of the apex, and there was conjugate movement of the eyes in this direction whichever way the prism was turned. 2. When the prism was moved before the amblyopic eye (O.S.), the patient saw no change in the image (no diplopia) and there was no movement of the eyes. After considerable coaxing and with the room darkened, the patient thought he could see a dim second image when the prism was placed in vertical positions but was unable to see any semblance of diplopia with the prism in horizontal positions.

CASE 4. D. M., presented a case of amblyopia ex anopsia with minimal inhibition. O.D. vision was 20/20, emmetropic. O.S. was amblyopic; vision 20/200 and with +1.25D. sph.  $\Rightarrow$  -5.00D. cyl. ax.  $30^{\circ}$ , 20/30—. There was no history of squint; the patient fixated binocularly and her eyes converged normally; angle gamma of O.D. was a larger positive angle than in O.S. There was no difference in response to this test whether correction was on or off. The patient had a degree of depth perception as judged by her ability to see Keystone DB 6 chart (figures 1, 2, 4, 5, and 6) correctly in the stereoscope; but was unable to see depth in the remainder and thought this to be so because the test objects were smaller. On the old Ver-

hoeff card she saw bars in depth correctly. The new Verhoeff depth apparatus used in the other three cases was not available for use in this case.

*Results of prism test.* 1. When the prism was moved before the O.S. (amblyopic eye) base down, the patient saw a new light above; when it was base up, she saw a new light below; when base in, saw a new light to the left; when base out, saw a new light to the right. That is, when the prism was moved before the amblyopic eye, the patient's response was normal. She reported a new light in the direction of the apex of the prism, and the observer noted that there was no movement of the eyes. 2. When the prism was moved before the O.D. (sighting eye) base down, she saw a new light below; when base up, a new light was above; when base out, a new light was to the right; when base in, she saw only *one* light. There was no second image. The observer noted that the patient's eyes moved conjugately in the direction of the apex. When the prism was moved before the good eye the patient's subjective response was anomalous, as she reported a new light in direction of the *base* of the prism. Usually in amblyopia no second image is seen when the prism is placed over the sighting eye, but, instead, a to-and-fro movement of the original image as the prism is moved back and forth. The reason for the unexpected diplopia response in this case on moving the prism before the sighting eye may be explained as follows: When the prism was placed before the amblyopic eye, the patient saw the original image remain stationary while the new one appeared in the direction of the apex of the prism (observer noted that the eyes remained stationary). When the prism was placed before the sighting eye, the patient stated that the "original image moves" in the direction of the apex of the prism, and "a new image appears" in the

direction of the base of the prism, and "follows the other image" in the direction of the apex. The observer noted that the patient's eyes moved conjugately in the direction of the apex.

CASE 5. C. S., had reduced vision in one eye without evidence of amblyopia ex anopsia; no retinal inhibition; normal response to the test. O.D., vision was 20/70; with +2.00D. sph.  $\approx$  -3.00D. cyl. ax. 70°, 20/25. O.S., vision was 20/20, emmetropic. There was binocular fixation, normal convergence, and negligible lateral phoria. Depth perception was normal with and without glasses, as judged by Verhoeff's apparatus and the Howard-Dohlman test. However, performance on the Howard-Dohlman apparatus was better with the correcting lens on.

*Results of prism test.* 1. When the prism was moved before the O.D., the patient saw the second image in the direction of the apex with the prism held in any position, and there was no movement of the opposite eye. 2. When the prism was

moved before the O.S., the patient saw a new image in the direction of the apex with the prism in any position, and there was no movement of the opposite eye.

Response then is that of a normal person with binocular vision and fusion and without any evidence of retinal inhibition, thus ruling out a diagnosis of amblyopia ex anopsia of the right eye.

One must assume in this case that, although there is reduced vision in the right eye, all the retinal elements contributing to the binocular image are active, and the brain is paying attention to the image of both eyes in the ultimate formation of the binocular image, even though one image is less distinct than the other. This condition differs from amblyopia ex anopsia of a minimal degree in that there is no evidence of inhibition of corresponding retinal points in the eye with poorer vision, as there is in amblyopia ex anopsia; and so binocular perception, fusion, and depth perception exist.

*Hammer Field.*

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# RELATIONSHIP BETWEEN THE BACTERIOLOGY OF THE CONJUNCTIVA AND NASAL MUCOSA\*

ESPECIAL REFERENCE TO CERTAIN EXTRAOCULAR INFLAMMATORY DISEASES

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The significant role that foci of infection may play in the etiology of chronic and recurrent diseases in various parts of the body has become increasingly evident as a result of recent investigations and clinical observations.<sup>1-10</sup> It is recognized that even remote foci of infection are capable of damaging susceptible tissues or organs by the liberation of toxins that are circulated through the blood and lymphatic systems. Therefore, it would seem reasonable to suppose that an active, or even a latent, focus of infection might be particularly pathogenic for adjacent and communicating tissues or organs. This study was undertaken because clinical and preliminary bacteriologic findings suggested the possibility of a causal relationship between conjunctival and nasal infections. This report deals entirely with extraocular inflammatory diseases. Consequently, in those cases in which there was an intraocular involvement as well, bacteriologic studies were made during exacerbation of the extraocular condition.

In order to compare the bacteriologic flora of the two membranes, it was necessary to determine not only the type of organism or organisms present in each, but also the toxicity of each of the individual "strains." *In-vitro* methods, whereby a "strain" recovered from the conjunctiva could be identified with that found in the corresponding nasal mem-

brane, would naturally be advantageous, even though the relationship between the two "strains" in such instances would be suggestive rather than conclusive. However, if in a large proportion of cases there should be a similarity between the flora of both the conjunctival and the corresponding nasal membranes, both as to type and toxicity of the bacteria, such a relationship might reasonably be assumed.

The word "toxicity" is used in this monograph to connote that general property of the microorganism which empowers it to damage tissues or to affect an animal or man adversely. Since there is considerable controversy among bacteriologists and immunologists regarding the precise significance of different tests involving pathogenic effects, or reactions associated with such effects, it might be more acceptable technically to use the term "probable pathogenicity." However, when a biochemical test is recognized as a reliable indicator of probable pathogenicity—as it is, for example, with the plasma-coagulating property of staphylococci—the test becomes, for practical purposes, a test of the "toxicity" of the culture.

In order to differentiate between the toxic and nontoxic strains of staphylococci, as well as to establish the degree of toxicity, the *in-vitro* methods advocated by Chapman, Berens, and their associates were used.<sup>11-17</sup> Certain of these *in-vitro* tests, such as mannitol fermentation, which was originally proposed by Julianelle,<sup>18</sup> and the coagulation of plasma, first shown by Darányi,<sup>19</sup> have been so improved that they are now recognized as

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indicators of probable pathogenicity by a number of investigators.<sup>20-31</sup>

In the early stages of this study, the pure strains of staphylococci found in cultures of the membranes were tested for the following properties: the ability to produce pigment, to coagulate rabbit or human plasma, to produce acid in 20 hours when grown on bacto phenol red

shown that in the process of "degeneration" and dissociation, the pathogenic "strains" sometimes lose one or more of their original biochemical properties and some eventually become completely negative. Only rarely does a nonpathogenic "strain" assume the characteristics of a pathogenic "strain." Of all the tests, the most reliable indicator of toxicity, as de-



Fig. 1 (Berens and Nilson). Iridocyclitis in the anterior segment of a rabbit eye 24 hours after an intravenous injection of 1 c.c. of coliform bacteria. The animal lived for 24 hours. At the end of six hours the eyes showed marked injection of the vessels of the iris and clouding of the anterior chamber. Pathologic examination revealed edema, congestion of the vessels, and areas of hemorrhage in the ciliary processes. Fibrin and a few polymorphonuclear leukocytes were scattered through the interstitial tissues of the iris and the ciliary processes. The epithelium of the iris and ciliary processes was necrotic in a few places. In the anterior and posterior chambers a fine granular precipitate was noted. Gram-negative bacteria were observed in vessels of the ciliary processes in another section from the same animal.

mannitol agar,<sup>17</sup> to grow on alkaline brom-thymol-blue lactose agar,<sup>17</sup> and to hemolyze rabbit-blood agar. "Strains" were considered highly toxic when they were positive to all these tests, while typical nontoxic "strains" were negative throughout. However, there were a number of "strains" which were atypical in that they were positive for only some of the tests. Previous investigations<sup>32</sup> have

terminated by the results of intradermal tests on rabbits, appeared to be the coagulation of plasma.<sup>32</sup> In the absence of the coagulating factor, it appeared that hemolysin in aureus strains and mannitol fermentation in either albus or aureus strains indicated only slight pathogenicity.

The more recent of these studies of eye and nasal cultures were limited to tests for chromogenesis, hemolysin production,

mannitol fermentation, and coagulation of plasma. Since the coagulating "strains" were highly dermonecrotic for rabbits, a coagulase-positive "strain" was considered toxic, regardless of the remaining reactions. For this reason, a coagulase-negative "strain," even though it gave positive reactions to the other tests, was considered a degenerate "strain" of modified or doubtful toxicity. However, a coagulase-negative "strain," which was positive to several other *in-vitro* tests, strongly suggested that it may have been derived from a toxic parent "strain."

Streptococci were also tested for probable pathogenicity by *in-vitro* methods.<sup>33, 34</sup> These tests consisted of exposing the pure dissociants to 1:125,000 hexylresorcinol for two hours. "Strains" in which growth was not affected by this treatment were considered pathogenic. The results have been found to correlate well with the resistance of streptococcal "strains" to the bactericidal action of fresh, diluted, defibrinated guinea-pig blood, the method formerly used by us for determining probable pathogenicity.<sup>35</sup> These *in-vitro* tests have correlated well with pathogenicity of both live and killed organisms for animals<sup>36</sup> and have given more reliable results than those previously used; that is, the complement-fixation test,<sup>37, 38</sup> agglutination reactions, the "pathogen-selective method," and intradermal tests for sensitivity of the patient to his own bacteria.<sup>39</sup>

Unfortunately, no satisfactory *in-vitro*-pathogenicity tests have been devised for the few other types of organisms occasionally isolated from the eye and nasal membranes in these cases. Other than staphylococci and streptococci, the group of organisms most frequently encountered were those of the coliform group. To determine the pathogenic properties of this group it is necessary to resort to animal inoculation. In order to

have the test conditions as nearly uniform as possible (the tests had to be made at different times whenever the organisms were isolated), a standard amount of "18-hour" broth culture of the freshly isolated strains was injected intravenously into rabbits of the *same age and weight* from the same genetic stock. It was shown that a moderate number of the coliform bacteria isolated from the eye or upper respiratory tract were quite toxic systemically for the rabbits, and that most of the strains produced a toxin having an unusually great affinity for the uveal tract, which manifested itself by the production of iridocyclitis<sup>40</sup> (fig. 1). The toxin rather than the organism itself appeared to be the agent mainly responsible for the uveal inflammation since in each case the filtrate alone was able to produce the same degree of iridocyclitis as did the corresponding amount of the culture from which it was derived. However, the intensity of the inflammation produced, as well as the general toxic effects, varied with the different strains of coliform bacteria.<sup>40, 41</sup>

The cultures reported in this study were taken according to clinical indications during the routine of private practice between April, 1939, and July, 1941. Conjunctival cultures were obtained by passing a dry, sterile, cotton swab along the lower cul-de-sac and the internal canthus. In cases in which the upper eyelid was involved, the upper tarsus was also swabbed. Material from hordeola and chalazia was cultured as expressed after incision. Nasal cultures were obtained by inserting a dry, sterile, cotton swab in front of the middle turbinate and then along the lower turbinate and the septum as far posteriorly as possible without shrinking the nasal membranes. A total of 83 sets of cultures was taken, each set consisting of a conjunctival culture from one or both eyes and a nasal culture from one or both nostrils. When the infection

appeared to be unilateral, the cultures usually were taken from the affected side only, although in several instances both sides were cultured for control purposes. The cases were divided into groups according to the bacteriologic findings. The eye conditions in which these cultures were taken were as follows: recurrent hordeola, chronic conjunctivitis, recurrent superficial keratitis, chronic meibomianitis and marginal blepharitis, allergic blepharoconjunctivitis, recurrent infected chalazia, and chronic purulent dacryocystitis.

#### BACTERIOLOGY OF THE NASAL MEMBRANES

Cultures from the nasal membranes yielded one or more of the following organisms, each of which is discussed in regard to incidence and significance: staphylococci, streptococci, coliform bacteria, and enterococci.

*Staphylococci.* It has been well established that staphylococci are recovered from the nasal membranes more frequently than is any other type of bacterium.

Jacobson and Dick<sup>42</sup> in examining the nasal flora of 500 persons found *Staphylococcus albus* in all the cultures. However, they apparently made no attempt to differentiate between toxic and nontoxic "strains", even on the basis of chromogenesis. These authors quoted Neumann, who isolated *Staphylococcus albus* in 98 percent and *Staphylococcus aureus* in 30 percent of 200 nasal cultures. Gillespie, Devenish, and Cowan,<sup>43</sup> using the same methods as used by us for determining pathogenicity, found an incidence of 43.4 percent pathogenic staphylococci in nasal cultures from 159 apparently healthy students. Of the 83 nasal cultures in our present series, 71 (85.5 percent) yielded some type of staphylococcus, in either pure growth or mixed culture. The inci-

dence of "toxic" staphylococci was 54 percent—36 of the nasal cultures yielding pure growths, whereas in 9 instances the pathogenic staphylococci were combined with other organisms. The organisms most frequently present in combination with staphylococci in the nasal membranes were streptococci (16 instances) and coliform bacteria (4 instances).

*Streptococci.* The presence of streptococci in either the nasal or conjunctival membranes was considered a pathologic sign whether or not the *in-vitro* tests indicated them to be pathogenic. We do not believe the streptococcus to be an inhabitant of normal nasal membranes because of its low incidence in nasal cultures and the fact that it has usually been associated with pathologic clinical signs or symptoms. This opinion coincides with that of Jacobson and Dick,<sup>42</sup> who claimed that "the presence of streptococci, pneumococci, *B. mucosus*, Pfeiffer bacilli, and diphtheria bacilli indicates disease of the nasal mucosa or sinus disease or both." Of the 83 nasal cultures in our series, streptococci were found in 18 (22 percent), only 2 of which were in pure growth.

*Coliform bacteria.* The presence of coliform bacteria in any part of the upper respiratory tract has also commonly been associated with pathologic clinical signs or symptoms. For this reason, as well as because of the marked toxicity of upper-respiratory coliform bacteria, as compared with fecal strains for rabbits, their presence in the nasal cultures was considered pathologic.<sup>40</sup> Like the streptococcus, they are not normal inhabitants of the nasal membranes. Jacobson and Dick<sup>42</sup> found coliform bacteria in only 1.2 percent, although they quoted a figure of 11 percent in Neumann's series. In a previous study, which included nasopharyngeal as well as nasal cultures of

411 patients with eye complaints,<sup>40</sup> we found coliform bacteria of some type in 24.8 percent of the cultures. Of the 83 nasal cultures in the present series, coliform bacteria were found in 13 (15.7 percent), and, since these were from only 9 patients, the actual incidence was lower. In nine of the cultures, the coliform bacteria were present in pure growth, the remainder were in combination with staphylococci.

*Enterococci.* No reliable test has yet been devised to estimate the probable pathogenicity of enterococci. However, they were found in only one instance in the nasal cultures, and are, therefore, usually not of particular importance in ocular infections of possible nasal origin.

#### DISCUSSION OF THE BACTERIOLOGY OF THE NASAL MEMBRANES

Toxic organisms of some type were found in 67 (81 percent) of the 83 nasal cultures in this series. Toxic staphylococci were present in the major portion with an incidence of 54 percent. The remaining 27 percent were mixtures that included streptococci and coliform bacteria.

What the incidence of toxic organisms might be in the nasal membranes of a group of "normals" would be hard to estimate, owing to the difficulty in obtaining really normal controls. One of the factors contributing to this difficulty is the existence of latent or occult foci of infection; for example, silent sinusitis, which may produce iritis.<sup>44</sup> Another factor is the influence of climate or seasonal changes on the flora of the nasal membranes, which might produce immunologic changes in the mucosa or alter the pathogenicity of the organisms inhabiting the membranes, or both. A large proportion of the patients seen by us have eye involvements which we believe to be associated with infections of the upper re-

spiratory tract, either in a primary or accessory role. Naturally these are the cases on which bacteriologic studies were made, and we have had little opportunity to study the nasal membranes of patients having no ocular pathology. However, in a number of cases in which the clinical appearance and ocular findings suggested a unilateral infection, the membranes on the unaffected side often yielded only nontoxic staphylococci, or a less toxic strain than that found on the side associated with ocular pathology.

#### BACTERIOLOGY OF THE CONJUNCTIVA

*Staphylococci.* Nontoxic staphylococci are considered by most investigators as common and normal inhabitants of the conjunctiva.<sup>45</sup> In the present series, 84.3 percent of the 83 eye cultures yielded staphylococci of some type. In certain extraocular inflammatory diseases, toxic staphylococci are present more frequently than is any other single type of organism. Of 280 cases of blepharitis studied by Thygeson,<sup>46</sup> 259 yielded toxic staphylococci, the staphylococcus in the majority of instances being the only significant organism found. In a previous study, dealing with various types of conjunctivitis, Thygeson<sup>45</sup> found that in 399 cases of chronic conjunctivitis, *Staphylococcus aureus* was present in pure growth in 175 instances and in mixed growths in 13 instances, a total incidence of 47 percent. In our present series, in which a number of extraocular diseases besides conjunctivitis were included, 29 percent of the conjunctival cultures yielded toxic staphylococci, usually in pure growth.

*Streptococci.* McKee<sup>47</sup> found streptococci in 16 of 100 conjunctival cultures and considered their presence pathologically significant even when the eye was apparently symptomless. In the present series streptococci were found in only 6

(7 percent) of the 83 conjunctival cultures, once in pure growth, the remainder in combination with staphylococci. In contrast, they were present in 22 percent of the nasal cultures.

*Coliform bacteria.* Although coliform bacteria were found in the conjunctiva in pure growth in six cultures (7.2 percent), they represented only two cases, since repeated cultures were taken in both. The incidence is, therefore, lower than that in the nasal membranes, in which these bacteria were found in 13 (15.7 percent) of the nasal cultures, representing 9 cases.

*Miscellaneous bacterial findings.* Other organisms found in these conjunctival cultures were enterococci, which appeared in mixed cultures in three instances, once with toxic staphylococci, once with non-toxic staphylococci, and once with diphtheroids. In five instances the cultures were sterile for 72 hours, after which they were discarded.

#### DISCUSSION OF THE BACTERIOLOGY OF THE CONJUNCTIVA

The incidence of toxic organisms found in the conjunctival membranes of this series was considerably less than that found in the nasal membranes. Of the 83 eye cultures, only 34 (41 percent) showed toxic organisms of any kind, as compared with 81 percent in the nasal cultures. Of the 41-percent positive eye cultures, toxic staphylococci were most common, with an incidence of 29 percent. The remainder (12 percent) was equally divided between pure and mixed growths of coliform bacteria and streptococci.

In discussing Thygeson's work on bacteriologic differentiation of the common forms of conjunctivitis, Weih<sup>45</sup> contended that all these pathogenic bacteria are found in the conjunctival secretion in normal conditions. Our findings do not indicate this to be so. On the contrary,

as can be seen from the present report, a large proportion of the patients with pathologic ocular changes failed to yield pathogenic organisms in the conjunctiva. This is to be expected in view of the greater exposure of the conjunctiva to oxygen as compared with the nasal membranes,\* the lysozyme and other antibacterial factors in the tears as well as their mechanical action. There is also the possibility that in certain instances, the condition may be due to bacterial allergy rather than actual infection, to some other form of allergy, or to a virus infection. Thygeson, in referring to the normal flora of the conjunctiva, pointed out that "in a considerable proportion of cases no bacteria are to be found. . . . Diphtheroid bacilli and white staphylococci are the more or less constant inhabitants. In the majority of cases (results of routine bacteriologic examination prior to cataract extraction) no pathogenic bacteria are found. . . ." In our own preoperative cases only rarely is a toxic organism recovered from the conjunctiva of a patient whose eye, after careful examination, shows no clinical evidence of extraocular disease. Operation is usually postponed in those rare instances in which an apparently normal conjunctiva is found to harbor a pathogen. It is possible that postoperative infections such as reported by McKee<sup>47</sup> may be thereby averted. In such cases it is advisable to make careful bacteriologic study of the nasal membranes, lacrimal sac, the meibomian glands, and the retrotarsal folds of the conjunctiva. In our opinion the presence of toxic organisms in the conjunctiva should be considered and treated as a pathologic finding.

\* The fact that the nasal membranes are half the time exposed to CO<sub>2</sub>, a factor favorable to the growth of staphylococci, may be of some significance.

TABLE 1

## GROUP 1

TOXIC ORGANISMS ISOLATED FROM BOTH NASAL AND CONJUNCTIVAL CULTURES  
(31 SETS OF CULTURES)

Case No.	Date	Conjunctival Culture			Nasal Culture			Extraocular Diagnosis
		Eye	Type	Toxicity	Side	Type	Toxicity	
11	7/18/39	OU	S. albus	+++	Both	S. albus	+++	Chronic meibomianitis
16	2/ 8/39	OU	S. aureus	+++	Both	S. aureus	+++	Chronic recurrent parenchymatous keratitis. Conjunctivitis
31	2/ 7/41	OD	S. albus	+++	Right	S. albus	+++	Chronic meibomianitis, marg. blepharitis
37	5/ 9/40	OS	S. albus	+ 0 +	Left	S. albus	+ 0 +	Chronic conjunctivitis OS
41	3/13/39	OU	S. aureus	+++	Both	S. albus	0 + +	Infected meibomian gland
59	6/21/40	OS	S. albus	+ 0 +	Left	S. albus	+ 0 +	Allergic dermatitis of lids, blepharitis. Question of bacterial allergy
67	9/ 8/41	OU	S. aureus	+ 0 +	Both	S. aureus	+++	Infected ammonia burns of cornea and lids associated with a cold
77	3/13/40	OS	S. aureus	+++	Left	S. aureus	+++	Chronic ulcerative marg. blepharitis OS Chronic meibomianitis
173	10/15/38	OD	S. albus	+++	Right	S. aureus	+++	Hordeolum-marginal blepharitis sicca. Abscesses of lids
173	11 /4 40	OU	S. aureus	+++	Both	S. aureus	+++	Hordeolum-marginal blepharitis sicca. Abscesses of lids
181	9/25/40	OS	S. aureus	+++	Both	S. aureus	+++	Allergic blepharoconjunctivitis
201	12/12/39	OU	S. aureus	+++	Both	S. aureus	+++	Acute conjunctivitis. Infected chalazion
229	12/20/39	OU	S. albus	+++	Both	S. albus	+++	Chronic meibomianitis—Folliculitis. Marginal blepharitis
244	4/26/39	OU	S. aureus	+++	Both	S. aureus	+++	Blepharitis
175	3/11/40	OD	S. aureus	+++	Right	S. aureus	+++	Allergic blepharitis, burning sandy feeling OD
178	1/ 5/39	OU	S. aureus	+++	Both	S. aureus	+++	Marginal blepharitis sicca
1	6/15/40	OS	B. proteus		Left	B. proteus		Styes, excessive tearing, and irritation
		OD	B. proteus		Right	B. proteus		
	11/29/40	OU	B. proteus		Both	B. proteus		
	3/ 1/41	OU	B. proteus		Both	B. proteus		
17	4/ 8/41	OU	Coliform bacteria		Both	Coliform bacteria		Keratitis (deep recurrent) OU
17	5/ 6/41	OU	Coliform bacteria		Both	Coliform bacteria		Keratitis (deep recurrent) OU
40	4/ 9/40	OU	S. aureus S. viridans	+++ 8+	Both	S. aureus S. viridans	+++ 8+	Folliculitis, chronic meibomianitis
51	11/28/41	OU	S. albus	+++	Both	S. viridans S. albus	6+ 0 0 +	Recurrent superficial punctate keratitis
70	2/26/41	OU	S. albus	+++	Both	S. viridans S. albus	8+ +++	Marginal ulcers. Keratitis
265	8/ 3/38	OS	S. aureus S. viridans	+++ 8+	Both	S. aureus S. viridans	+++ 8+	Allergic blepharitis. Infected chalazion
281	9/10/38	OU	S. albus Non-hem. ent.	+++	Both	S. aureus	+++	Chronic meibomianitis
287	12/ 4/38	OS	S. albus Non-hem. strep.	0 0 0 6+	Left	S. albus N. H. Strep. Diphtheroids	0 0 0 6+ (?)	Conjunctivitis
15	1/29/40	OS	S. aureus	+++	Both	B. proteus		Chronic meibomianitis
268	10/28/38	OU	S. viridans S. viridans	4+ 4+	Both	S. aureus Coliform bacteria	+++	OS bloodshot at times. Considerable congestion OU
218	7/12/40	OU	S. viridans S. albus	0 ± 0 0 0	Both	S. albus	+++	Mild chronic meibomianitis Follicular conjunctivitis

Order of toxicity tests for staphylococci: (1) Mannitol fermentation, (2) Hemolysin, and (3) Coagulase. Designation of streptococcal pathogenicity 0 through 8+.

The presence of streptococci, whether toxic or not, is considered pathologic when found in the nasal or conjunctival membranes.

COMPARISON OF BACTERIOLOGY OF THE  
NASAL MEMBRANES AND  
CONJUNCTIVA

*Group 1* consisted of 31 sets of cultures in which both the conjunctival and nasal membranes showed toxic organisms (table 1). Toxic staphylococci were found in both cultures in pure growth in 16 instances and in combination with strepto-

suspected as the sole etiologic agent. Obviously the toxic staphylococcus predominates in this group, since of the 26 cases represented (two or more sets of cultures were taken in three cases), toxic staphylococci were present in one or both cultures in 23 cases. It will be noted in table 1 that the same organisms were present in both conjunctival and nasal membranes

TABLE 2

NONTOXIC ORGANISMS OF THE SAME TYPE ISOLATED FROM BOTH NASAL AND CONJUNCTIVAL CULTURES  
OR  
NONTOXIC ORGANISMS IN NASAL CULTURES WITH STERILE EYE CULTURES  
(13 SETS OF CULTURES)

Case No.	Date	Conjunctival Culture			Nasal Culture			Extraocular Diagnosis
		Eye	Type	Toxicity	Side	Type	Toxicity	
48	4/ 2/38	OU	S. albus	0 0 0	Both	S. albus	0 + 0	Chronic meibomianitis
63	11/20/39	OU	S. albus	0 + 0	Both	S. albus	0 + 0	Allergic blepharitis
73	4/ 6/39	OU	S. albus	0 + 0	Both	S. albus	+ + 0	Recurring keratitis
71	2/ 4/41	OU	S. albus	0 0 0	Both	S. albus	0 0 0	Chronic conjunctivitis
83	5/15/40	OU	S. aureus	0 0 0	Both	S. albus	0 + 0	Keratoconjunctivitis—cause undetermined in 13 years.
138	5/19/39	OD	S. albus	0 0 0	Both	S. albus	0 0 0	Recurrent purulent conjunctivitis
228	12/18/39	OU	S. albus	0 + 0	Both	S. albus	0 + 0	Allergic blepharitis. Chronic meibomianitis
234	3/10/41	OU	S. albus	0 0 0	Both	S. albus	+ 0 0	Allergic dermatitis and blepharitis. Follicular conjunctivitis
270	1/12/38	OU	S. aureus	+ 0 0	Both	S. aureus S. albus	0 0 0 + 0 0	Blepharitis sicca—Conjunctivitis OU—Seborrhea capiti
287	12/ 4/38	OD	S. albus	0 0 0	Right	S. albus	0 0 0	Chronic conjunctivitis
51	6/11/40	OD	Sterile	.	Both	S. albus	0 + 0	Recurrent superficial punctate keratitis
271	3/ 1/39	OS	Sterile		Left	S. albus	0 0 0	Sandy feeling OS—lids puffy. Meibomian glands prominent
197	4/23/40	OD	S. albus Hemolytic enterococci	0 0 0	Both	Hemolytic enterococci Nonhem. enterococci		Vesicular and parenchymatous keratitis

cocci in four instances. In three other instances, toxic staphylococci were present in only one of the cultures, the corresponding culture showing some other type of toxic organism. Coliform bacteria were found in pure growth in both nasal and eye cultures in six instances and in the culture from one membrane only in two instances; one in combination with toxic staphylococci, the other in pure growth. Streptococci were usually found in combination with toxic staphylococci, and in only one instance could they be

is pure growth in 22 instances, and at least one of the organisms was found in mixed growth in both cultures in 6 instances. Thus 28 of 31 sets of cultures showed a suggestive association between the flora of the nasal and conjunctival membranes. Equally suggestive is the fact that in most instances in which toxicity tests showed a strain of staphylococcus to be atypical, the characteristics in which it deviated from the normal were present in both the nasal and the eye strain; whereas in the case of streptococci, the degree of



TABLE 3

## GROUP 3

TOXIC ORGANISMS ISOLATED FROM NASAL MEMBRANES AND NONTOXIC ORGANISMS FROM  
CORRESPONDING CONJUNCTIVAL MEMBRANES  
(36 SETS OF CULTURES)

Case No.	Date	Conjunctival Culture			Nasal Culture			Extraocular Diagnosis
		Eye	Type	Toxicity	Side	Type	Toxicity	
3	3/21/40	OD	S. albus	0 0 0	Both	S. aureus	+++	Chronic meibomianitis
47	8/18/41	OU	S. albus	0 0 0	Both	S. albus S. aureus	+ 0 0 +++	
58	2/ 5/40	OU	S. albus	0 0 0	Both	S. aureus	+++	Chronic meibomianitis
60	5/20/41	OU	S. albus	0 0 0	Both	S. aureus	+++	Chronic conjunctivitis
78	1/27/39	OS	S. albus	0 + 0	Both	S. aureus	+++	Recurring keratitis chronic conjunctivitis
94	2/17/42	OD	S. aureus	0 + 0	Right	S. citreus	+++	Congestion of conjunctiva associated with glaucoma
105	11/10/39	OU	S. albus	+ + 0	Both	S. aureus	+++	Conjunctivitis OU
155	11/22/39	OU	S. albus	0 0 0	Both	S. aureus	+++	Marginal ulcers and blepharitis. Chronic meibomianitis, corneal ulcer
	2/15/40	OU	S. albus	0 0 0	Both	S. aureus	+++	
248	1/ 8/41	OU	S. albus	0 0 0	Both	S. aureus	+++	Recurrent chronic conjunctivitis
255	2/19/42	OD	S. albus	0 0 0	Right	S. aureus S. albus	+ 0 + +++	Eczematous conjunctivitis. Marginal blepharitis sicca—senile keratitis
						S. albus S. aureus	0 0 0 +++	
256	9/ 6/40	OU	S. albus	0 0 0	Both	S. aureus	+++	? of vernal catarrh—itching, secretion OU
259	8/ 6/41	OD	S. albus	0 + 0	Both	S. aureus	+++	Dendritic keratitis, ulcer cornea. Allergic blepharitis with vesicles
85	2/23/39	OD	S. albus S. albus	0 0 0 0 + 0	Right	S. aureus S. albus S. albus	+ + + 0 0 0 + 0 0	Infected chalazion
272	8/27/37	OS	Sterile		Both	S. aureus	+++	Scleritis
275	1/ 3/38	OU	S. albus	0 0 0	Both	S. albus S. aureus	0 0 0 +++	Allergic blepharoconjunctivitis
285	10/25/37	OD	S. albus	0 0 0	Both	S. aureus	+++	Calcareous conjunctivitis
32	5/ 1/39	OU	S. albus	0 0 0	Both	S. viridans S. aureus	0 +++	Blepharitis
106	2/20/42	OU	S. albus	0 0 0	Both	S. viridans S. aureus	0 +++	Acute conjunctivitis
227	3/17/39	OU	S. albus	0 0 0	Both	S. viridans S. aureus	0 +++	Chronic conjunctivitis
138	2/23/39	OU	S. albus	0 0 0	Both	S. viridans S. albus	8 + & 0 0 + 0	Recurrent mucopurulent conjunctivitis
222	11/18/40	OD	Sterile		Both	S. viridans S. albus	8 + 0 0 0	Chronic blepharoconjunctivitis
234	12/20/41	OU	S. albus	0 + 0	Both	S. viridans S. albus	0 & 8 0 + 0	Follicular conjunctivitis. Allergic dermatitis and blepharitis
235	11/16/39	OU	S. albus	0 0 0	Both	S. viridans S. albus	0 0 + 0 & 0 0 0	Chronic conjunctivitis OU
264	3/20/41	OU	S. albus	0 0 0	Both	S. viridans S. albus	8 + 0 0 0	Old fascicular keratitis.
270	1/11/38	OS	S. aureus	+ 0 0	Both	S. viridans S. albus	0 + 0 0	Seborrhea capitis—blepharitis sicca—conjunctivitis OU
278	12/21/38	OU	S. albus	0 + 0	Right	S. viridans S. albus	0 0 + 0	Dacryocystitis.
267	8/ 9/37	OU	S. albus	0 0 0	Both	S. viridans S. albus	0 0 0 0	Purulent dacryocystitis OS
180	10/25/40	OD	S. albus	0 0 0	Right	S. viridans	8 +	Blepharoconjunctivitis

TABLE 3—Continued

Case No.	Date	Conjunctival Culture			Nasal Culture			Extraocular Diagnosis
		Eye	Type	Toxicity	Side	Type	Toxicity	
265	1/ 9/41	OU	S. albus	0 0 0	Both	S. viridans	0	Allergic blepharitis. Infected chlamydia (recurrent)
	12/ 5/39	OD	S. albus	0 0 0	Both	Coliform bacteria S. albus	+++	
2	5/25/40	OU	S. albus	0 + 0	Both	Coliform bacteria S. albus	0 + 0	Chronic conjunctivitis, blepharitis and meibomianitis, Seborrhea capitis
169	2/ 4/42	OU	Sterile		Both	S. albus + 0 0 & Coliform bacteria S. albus	0 0 0 + 0 0	Chronic conjunctivitis OU
223	6/29/39	OU	S. albus	0 0 0	Both	Coliform bacteria		Chronic blepharitis and conjunctivitis
221	11/13/40	OU	S. albus	0 0 0	Both	Coliform bacteria		Chronic meibomianitis
284	3/10/38	OU	Diphtheroids Nonhem. enteroc.		Both	S. aureus	+++	Conjunctivitis OU

resistance to hexylresorcinol was usually the same in both ocular and nasal strains.

*Group 2* consisted of 13 sets of cultures in which both nasal and conjunctival cultures were negative; that is, either sterile or showing nontoxic organisms (table 2). Of these, 10 showed a pure growth of nontoxic staphylococci in both cultures, 2 showed sterile eye cultures with nontoxic staphylococci in the corresponding nasal culture, and 1 showed enterococci in both cultures with the addition of nontoxic staphylococci in the nose.

*Group 3* consisted of 36 sets of cultures in which the eye cultures were negative; that is, either sterile or containing nontoxic organisms, whereas the nasal cultures showed toxic organisms (table 3). Of the 36 eye cultures, 32 showed non-

toxic *Staphylococcus albus*, 3 were sterile, and 1 showed a mixed culture of diphtheroids and nonhemolytic enterococci. Of the nasal cultures, toxic staphylococci were present in pure culture in 18 instances and in mixed culture in 4 instances, a total incidence of 61 percent. Streptococci were found in the nasal cultures in 13 instances, once in pure culture, the remainder in combination with staphylococci. There appeared to be a tendency for the staphylococci to be nontoxic in the presence of streptococci, since in only 3 of 11 instances were toxic staphylococci combined with streptococci. Coliform bacteria were found in the nasal cultures in 5 instances, twice in pure culture and the remainder in combination with staphylococci.

TABLE 4

## GROUP 4

TOXIC ORGANISMS ISOLATED FROM CONJUNCTIVAL MEMBRANES  
AND

NONTXIC ORGANISMS FROM CORRESPONDING NASAL MEMBRANES  
(3 SETS OF CULTURES)

Case No.	Date	Conjunctival Culture			Nasal Culture			Extraocular Diagnosis
		Eye	Type	Toxicity	Side	Type	Toxicity	
140	12/10/38	OS	S. aureus	+ 0 0	Both	S. aureus	+ + 0	Chronic conjunctivitis—superficial punctate keratitis
153	2/ 1/42	OS	S. albus	0 + +	Both	S. albus	0 0 0	Conjunctivitis after left antrum infection
269	11/10/37	OD	S. viridans	5 +	Both	S. aureus	+ + 0	Chronic conjunctivitis after scarlet fever
		OS	S. albus	0 0 0				

Group 4, in which the eye cultures proved to be somewhat more toxic than the nasal cultures, consisted of only three sets of cultures (table 4). Even in these the difference between the toxicity of the two flora is not marked.

#### DISCUSSION

In comparing the bacteriology of the nasal and conjunctival membranes, it may be seen from tables 1 and 3 that the nasal cultures tend to be more toxic than the conjunctival cultures. In groups 1 and 2 there was a definite bacteriologic relationship between the flora of the conjunctival and nasal membranes. It has been stressed<sup>48</sup> that this nose-to-eye relationship, as far as the bacteria themselves were concerned, was "mainly the fingers and handkerchief, from nose to eyelid margins and then to the conjunctiva." This, however, would not explain chronic unilateral eye conditions, which are so often associated with unilateral nasal conditions on the same side. In group 1, 28 of the 31 cultures showed strains of the same type and toxicity in both nasal and eye cultures, while only three sets of cultures showed toxic bacteria of different types in the nose and eye. In group 2, 11 of 13 cultures showed the same type of nontoxic organisms in both eye and nose while the two remaining eye cultures were sterile, with nontoxic bacteria in the corresponding nasal cultures. Thus, of 83 sets of cultures, 41 (50 percent) showed a definite relationship between the conjunctival and corresponding nasal culture.

In groups 3 and 4, there was no apparent relationship between the nasal and conjunctival findings. In group 3, all of the 36 nasal cultures showed toxic organisms, whereas the corresponding eye cultures were either sterile or showed only nontoxic organisms. This is an incidence of 43.3 percent showing toxic or-

ganisms in the nose with negative conjunctival findings. In group 4, the three eye cultures showed organisms somewhat more toxic than those found in the corresponding nasal cultures. This is an incidence of only 3.6 percent in which the conjunctival cultures could be considered more toxic than the nasal cultures.

The marked similarity of the findings in the corresponding nasal and eye cultures of groups 1 and 2 seems to denote a bacteriologic relationship. The negative findings in group 2 and the positive findings in group 1 are difficult to explain in view of the fact that on the whole the same type of clinical eye symptoms prevailed in both groups. A study of the records of these patients, however, reveals that in two instances these cultures were taken from the uninfected side of a unilateral eye infection, in two other instances earlier culture had yielded toxic organisms, and in another instance subsequent cultures proved to be toxic. Of the remaining eight sets of cultures, six had toxic organisms in the nasopharynx at the time, even though nasal cultures were negative, one had previously yielded toxic organisms in nasopharyngeal culture, and one had only nasal and conjunctival cultures so that nasopharyngeal bacteriology remained unknown; in this case, however, roentgenograms revealed infection in the left antrum.

Another question then arises as to whether the toxic organisms found in the nasal membranes of group 3 could be associated with the ocular pathologic changes in these patients in spite of the negative ocular-bacteria findings. Thygeson, in his paper on staphylococcus blepharitis<sup>49</sup> stated that "there is no question but that *bacteria* may be the primary cause of inflammation of the lid margin." He had also stated in a previous paper<sup>45</sup> that "the clinical picture of staphylococcus conjunctivitis has been reproduced in man

and animals by instillations of *exotoxin*." The work of Morax and Elmassian<sup>49</sup> supports this contention; they produced acute conjunctivitis in man and animals by the instillation of broth filtrates. Allen<sup>50</sup> also produced acute conjunctivitis by instillations of staphylococcus toxin. Toxic staphylococci are capable of producing a potent exotoxin. It seems logical to believe that some of the potent staphylococcal exotoxin, produced in nasal or sinus membranes, might find its way into the conjunctiva or the surrounding glands and tissues. That toxins do reach the conjunctiva is suggested by the fact that in so many of these patients, exacerbation of the ocular condition followed closely or coincided with a nasal "flare-up," sinusitis, or a "cold," in which the nasal membranes were involved. Also, treatment of the nasal infection in chronic cases is often followed by improvement or eradication of the eye condition. An example of this may be seen in cases of recurrent hordeola, in which it is difficult to obtain viable organisms at the time of rupture, since by that time most of the bacteria have been phagocytosed. On the assumption that a toxic staphylococcus is usually the etiologic agent in the production of hordeola, and since the *nasal* passages usually yield a toxic staphylococcus in these cases, we have sometimes made vaccines from the nasal staphylococci. From the study of clinical records, these vaccines apparently have proved fully as beneficial in preventing recurrence of hordeola as those prepared from conjunctival strains when they were obtainable.

The question has been raised as to the route by which the toxin produced in the nasal membranes might reach the eye, and the lacrimal duct has been considered as one possible avenue. Thygeson<sup>48</sup> believes this to be "theoretically impossible owing to the constant flow of tears in the opposite direction." However, in many of these cases we have observed partial or com-

plete obstruction of the lacrimal duct, with epiphora, which usually indicates disease. Furthermore, the flow of tears would not seem to be of sufficient force to sweep back approaching toxins or bacteria but only sufficient to keep the mucous membrane moist, a condition favorable to the transfer of these substances. Another possible way in which the nasal toxins might affect the eye is by causing reflex irritation, thus disturbing the vasomotor mechanism. Stauffer<sup>51</sup> believes this reflex stimulation causes nutritional disturbance, which, in turn, impairs the function of the organ, thus producing various diseases. He further states that while diseases of the eye may be produced by reflex irritation alone, they are most frequent when the nerve supply to the part is impaired by direct transfusion of toxins from adjacent suppurating cells. The blood and lymph have also been mentioned as possible channels for the distribution of toxin, but, even in these, proximity of the source might play an important role in affecting adjacent organs.

Probably the most significant findings in this study are those recorded in table 4, which show that in only 3 of 83 sets of cultures could the eye culture be considered more toxic than the nasal culture, and even in these, the difference was slight. This strongly suggests that the eye condition in most of these cases was endogenous and that the primary cause was an infection from the nasal membranes rather than an infection from external foci such as the scalp or skin.

Thygeson<sup>48</sup> suggested that overactivity or altered activity of the glands of the eyelid margin may be a predisposing factor in staphylococcus blepharitis. However, he conceded that "seborrhea does not appear to be necessary to the production of staphylococcus blepharitis," and that in his series "there were a number of individuals without seborrheic skins or scalps and with normal meibomian

glands." In considering the etiology of these extraocular inflammatory diseases, it would, therefore, seem more logical to suspect nasal infections as primary foci, in some cases, rather than the surrounding external tissues or glands. It is not suggested that all persons having nasal infections will eventually have extraocular infections because the latter is only one of many possible effects. That the released toxins may be capable of causing intraocular involvement or any of a number of diseases in other parts of the body, as well as extraocular disease, is readily admitted. However, in view of the bacteriologic findings in this series of cases, it would seem advisable to culture the nasal membranes when investigating the etiology of chronic or recurrent inflammatory diseases of the outer eye. Examination and roentgenograms of the sinuses and nasal membranes show that in the majority of these cases, the clinical findings support the bacteriologic data.

#### SUMMARY AND CONCLUSIONS

1. Of the 83 sets of cultures taken from the nasal and conjunctival membranes of 75 patients with extraocular diseases, 50 percent yielded organisms similar in type and toxicity in both conjunctival and corresponding nasal cultures, 43.3 percent yielded "toxic" nasal cultures with corresponding "negative" conjunctival cultures, and approximately 3.5 percent yielded organisms of slightly greater toxicity in the eye than in the nose.

2. That 50 percent of these patients showed similar organisms in both nasal and conjunctival cultures suggests a bacteriologic relationship between the two membranes. It is significant that in those

instances in which the strains were atypical in their *in-vitro* reactions, this deviation from normal was generally found in both the nasal and the corresponding conjunctival strain.

3. That the nasal culture should prove more toxic than the eye culture in over 43 percent of the patients with extraocular inflammatory diseases suggests that the nasal membranes may be the primary foci in these cases. It would seem logical to suppose that the toxin produced in the nasal membranes might easily find its way to the conjunctival membrane, even if the bacteria do not, and that repeated penetration of the toxin might sensitize the conjunctival membranes and surrounding glands.

4. The fact that 96.5 percent of these cultures showed organisms of equal or greater toxicity in the nose as compared with the eye, and that in only 3.5 percent were the conjunctival cultures more toxic than the nasal cultures suggests that the primary source of infection is endogenous rather than exogenous.

5. The bacteriologic relationship between nasal and conjunctival infections is substantiated by clinical symptoms and signs of pathology in many cases in which nasal exacerbations coincide with or are closely followed by ocular symptoms.

6. In determining the etiology of chronic and recurrent extraocular inflammatory diseases, it is advisable to investigate the nasal mucosa as a possible source of infection.

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# NOTES, CASES, INSTRUMENTS

## ADIE'S SYNDROME

### A CASE REPORT

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The syndrome of Adie has attracted considerable interest of late, the recent paper of Dynes being an especially lucid presentation of the history and peculiarities of the symptom complex bearing this eponym. The reader is referred to the appended references for a fuller description, but emphasis on the main features may not be amiss before presenting the case report which forms the main purpose of this paper.

Adie's syndrome consists of myotonia of the pupil, mostly unilateral, usually but not necessarily accompanied by absence of one or more of the deep tendon reflexes. These are commonly the knee and ankle responses. The tonicity of the pupil results in dilatation with absent or delayed response to light and normal or exaggerated normal accommodation reflex. The condition mimics and is often mistaken for tabes, but differs from it in several important respects. In the Adie syndrome both the blood and spinal fluid are serologically negative, and the pupillary fixation to light is often unilateral. It is obvious that a knowledge of the syndrome is important if the physician would avoid attaching the stigma of tabes to patients with this condition.

The case reported in this paper is one of unusually long duration. Aside from this it has no very unusual features, being, in the author's opinion, a classical example of the condition.

M. S. was born into a large family, living in the country on a small farm. He had the usual childhood diseases and at

the age of three had an attack of pneumonia, and another attack of the same disease at the age of five. During his childhood he carried out a fairly strenuous work routine, but remained in good health until he was 14 years old. At that time he began to have attacks of sciatica, first on one side, and then the other, but more frequently on the left. These attacks recurred for many years and then ceased altogether. At the age of 17 years he sustained an injury to the left side of his head as the result of a fall from a horse. Although he was able to remount the horse and continue on his journey after the fall, he was apparently unable to remember the purpose of his travel. This was the only symptom connected with the injury, and he continued in good health, entered college, and became active in sports while there.

After completing his studies at college and medical college, and an internship, he entered the Army Medical Corps in 1900. It was during his period as a student at the Army Medical School in Washington, D.C., that he first noticed the wide dilatation of the pupil of his left eye. Thinking that he had accidentally splashed a mydriatic into his eye, he waited two or three days for the pupil to return to normal, but at the end of this time it was in the same stage of dilatation. He then consulted a specialist, underwent a thorough physical examination and it was found at this time that in addition to the dilatation of the pupil, there was absence of the left patellar reflex and reduction of the right. The tendo achillis and cremasteric reflexes were normal, and there were no areas of paresthesia nor anesthesia on any region of the body. The pupil of the left eye remained fixed, and no reaction could be elicited, even with a

strong light, although the other pupil reacted to light both directly and consensually. Under a mydriatic the pupil of the left eye dilated to the same degree as the right but was slower in contracting after the effect of the drug had ceased. The left pupil also contracted under a miotic. Close examination revealed slight contraction in accommodation, slight dilatation to darkness, and sluggish reaction upon entering a well-lighted room. Biateral vision was 20/15, and there was no difficulty in close accommodation. The eye-grounds were normal, and, aside from the aforescribed symptoms, no pathologic changes were found. The pupil gradually contracted until it was slightly larger than the right during the day and smaller in a shaded room.

Many examinations were undergone and many specialists consulted in an effort to ascertain the etiology of these findings. The results of tests of the blood and spinal fluid, made on many occasions, were always negative. No definite diagno-

sis was established.

From the onset of these symptoms to the present time, a period of some forty-odd years, I have examined the patient on many occasions. No other symptoms nor signs have ever developed, and he has been able to carry out his daily activities without difficulty of any kind.

The fact that the symptoms and signs have remained unchanged over such a long period of time suggests that the syndrome remains stable when it has become well established. Since the etiology of the condition is unknown, the history of trauma in this patient may be of some importance. It is not the author's intention to attempt any generalizations based on the history of one patient, and the function of this report must remain that of the presentation of an interesting and illustrative case report and a reminder that this condition is frequently mistaken for a much more serious and disturbing malady.

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## TREATMENT OF EPITHELIAL INGROWTH FOLLOWING CATARACT EXTRACTION

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The wild growth of epithelial tissue into the anterior chamber is a serious complication of intraocular surgery and perforating injuries of the anterior segment of the eyeball. The actual causative factor is unknown. Its occurrence is infrequent. It is realized, however, that if not treated, the eye is destroyed by secondary glaucoma, because the tissue proliferates to fill the angle.

Previous to the recent use of the X ray and radium, attempts at surgical removal have been more or less futile, owing to the very nature of the disease. As the disease entity may have been started by a single misplaced epithelial cell, it would entail great manipulation to try to remove every last cell of this wild-growing tissue.

The use of the X ray is doubly advantageous here in that it obviates the necessity of opening the eye a second time—generally more hazardous than the original operation. It also acts to destroy those rapidly proliferating cells much more thoroughly than would be possible by the aid of the human eye, and without damaging normal cellular tissue, so long as the proper dosage is employed. Perera<sup>1</sup> has reported a case treated by the X ray and has reviewed the subject recently.

The case of the patient whose history follows differs from the usual course in several respects. The treatment was instituted earlier following operation, the initial dosage was greater, and only one course of X-ray treatments was necessary to bring about a cure. It was felt that these factors were important because the less differentiated and younger the cells are the more sensitive they are to X-ray irradiation. Secondly, it is felt that as

large a dose should be used initially as is compatible in order to destroy this tissue without exposing normal cells to its destructive effect.

G. C. D., a man, aged 47 years, had gradually lost the sight of his right eye during the year previous to operation. Examination showed a cortical cataract with good light perception and projection. The past history was chiefly negative, except that he had also had a cataract in his left eye one year earlier, extracted by the writer without complication; resulting vision was 20/20 with correction.

The right eye was operated on on March 24, 1943, an intracapsular extraction and total iridectomy being performed. Recovery was uneventful and the patient was discharged from the hospital on April 5, 1943. On April 15th, a faint white membrane was observed in the anterior chamber, growing down from the corneoscleral junction at the 12-o'clock position. There were no signs of inflammation. This condition was kept under observation until April 20th, and its slow progress downward noted. X-ray irradiation was begun on this date by Dr. C. R. Crain. It was decided to use 200r for the first dosage, and a weekly treatment of 150r for four more exposures. At the end of the week the tissue had not advanced farther and was beginning to disappear. Complete recovery took place thereafter, and, when last seen, on December 1, 1943, the eye showed no evidence of recurrence. The vision in this eye with +11.00D. sph. = +1.25D. cyl. ax. 180° was 20/20.

*Summary.* A case of epithelial ingrowth into the anterior chamber of the eye following cataract extraction is reported.

Its successful treatment by X-ray irradiation is outlined.

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# SOCIETY PROCEEDINGS

EDITED BY DONALD J. LYLE

## ROYAL SOCIETY OF MEDICINE

### SECTION OF OPHTHALMOLOGY

November 13, 1942

MR. FRANK A. JULER, *president*

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### RETINOSCOPY

MR. M. KLEIN said that the principle underlying clinical measurement of the "refraction" of the eye is to determine the position of the image in space of a light source which in this case is the retina. In practice the determination of the image is very difficult. In retinoscopy the aperture test is used, by means of which it is possible to determine the "crossing point"; that is, the image plane of a light pencil.

In this presentation the retinoscopic field can be dispensed with, and the mirror-hole itself substituted for it. Another factor is the speed of shadow movement. The emitted light pencil is divergent in hypermetropia, convergent in myopia, but beyond the crossing point this becomes divergent again. With the increase of the refractive error the convergency or divergency of the light pencil increases. When spectacle lenses are placed before the eye, and the refractive error is being corrected, the area of the light pencil becomes smaller and smaller, and very little movement of the mirror will be sufficient to pass the light pencil over the mirror-hole (increase of speed).

The next factor is the brightness of the pupillary light, which is subdivided into four separate factors: (1) Brightness of the source, which, if increased,

will increase the illumination of the retinal light patch: (2) distances which cause a decrease in illumination with the square of the distance; (3) apertures which consist of the edge of the mirror, the patient's pupil, and the mirror-hole or the examiner's pupil; (4) losses in transmission, which are caused by imperfect reflection and by absorption of light.

Still another factor is the neutral point, and the question as to why there is a sudden change of shadow and light at the neutral point was discussed. At the neutral point there are no confusion circles, and the area of an image element is so small that when it passes the aperture at all, it passes entirely. This means that the light patch on the retina appears or disappears suddenly. Another question that arises is what happens in the examiner's eye during retinoscopy. If the refractive error of the patient's eye is high, the examiner can see fundus details. As the refractive error is being corrected in the course of retinoscopy, the fundus details become more and more blurred, because the examiner's eye is unable to bring the emitted light pencil to an image. Factors influencing the neutral point are aberration, decentration of the cornea, and the unevenness of the retinal surface.

### INTRAOCULAR NEOPLASM

S/LDR. G. WILLOUBY CASHELL presented the case of a 37-year-old corporal. In 1940 he was struck in the right eye with an empty cartridge case. Apart from momentary blurring of vision he had had no trouble with the eye and since then had been serving overseas. After his return to this country the eye remained satisfactory until September, 1942, when he noticed a slight haziness in vision. At the

same time he noticed flashes of light in the right eye, especially at night. He had had no trouble with the left eye.

On examination the left eye was found to be in good condition with vision of 6/6. The pupil was normal and the media and fundus were clear.

The vision in the right eye was 6/24. He had never worn glasses. The pupil was active and the ocular movements were full. Examination of the fundus of the right eye revealed above the disc and macula a circular cystlike detachment of the retina. No hole could be seen, the lower part of the cyst appeared to be transparent, but along the upper border there was a grayish-white reflex with some proliferation of pigment. Transillumination threw an opaque shadow in the upper part of the globe. The peripheral visual field was full, but there was a scotoma corresponding to the affected area of the retina. There was a shallow detachment of the lower part of the retina.

On general medical examination no evidence of metastases was found. X-ray studies of the skull and chest were normal. Ear, nose, and throat examination was negative.

A diagnosis of choroidal sarcoma of the right eye was made.

*Discussion.* Mr. Juler said that he thought this case was one of malignant melanoma which should be excised.

S/Ldr. Cashell said that a similar case was shown by Air Commodore Livingston, which was taken to be innocent, but later the growth increased and the eye had to be enucleated. It was found to contain a neoplasm.

Mr. G. W. Black said he had seen a 22-year-old man who was hospitalized following a blow on his eye from a large missile. He was treated for a time and then it was discovered that the vision was very dim. When he first saw the patient the latter had a large sarcoma.

## CHIASMAL ARACHNOIDITIS

DR. A. J. B. GOLDSMITH gave a sketch of the history of the development of the syndrome of chiasmal arachnoiditis, a localized meningitis.

The essayist added three cases, the first of these with headache, pituitary and anterior hypothalamic symptoms. This patient had loss of vision in the right eye with some temporal contraction in the left eye. Temporal pallor of the discs was marked. Many fine avascular adhesions bound the pink nerves and anterior chiasm to the overlying brain, internal carotid artery, and diaphragma sellae.

The second patient complained of headaches and vertigo. The vision in the right eye was reduced to the perception of hand movements. In the left eye the visual field was concentrically constricted. The disc of the right eye was pale, that of the left normal. There was also involvement of the right first, fifth, and eighth nerves. Exposure of the area at operation revealed the optic nerve of the right eye to be covered with convoluted vessels and adhesions which bound both nerves, chiasm, brain, and internal carotid arteries. Some fluid was found loculated between the optic nerve of the right eye and the carotid artery.

The third patient also had headaches with edema of both papillae. Vision was reduced to perception of hand movements in the right eye and to 6/60 in the left eye. Peripheral visual fields were normal, but a large central scotoma was found with the right eye, and a small central scotoma with the left eye. At operation the pink nerves and chiasm were bound by a mass of fine adhesions to the overlying brain.

The usual findings in chiasmatic arachnoiditis, and further borne out by these cases, are as follows: There is frequently observed upon ophthalmoscopic examination an early congestion of the papillae, and a later atrophic pallor. Operation

usually reveals fine adhesions which are generally rather extensive in the chiasmal area, binding the nerves, chiasm, dorsum sellae, carotid arteries, and base of the brain. These adhesions may be vascular or avascular. Cystic fluid or calcareous plaques may be found. In these cases tumors have been excluded.

Attributing causes are: (1) inflammatory extension from nasal sinuses; (2) syphilitic basal arachnoiditis in the chiasmal area; (3) tuberculosis and other leptomeningitic infections; and (4) trauma.

Loss of vision is usually found first in one eye. The visual field defects are: (1) central scotoma; (2) concentric contractions; (3) temporal loss; and (4) nasal, altitudinal, and homonymous defects.

The optic nerve shows (1) primary atrophy; (2) secondary (postpapillitic) atrophy; (3) papilledema; (4) temporal pallor; and (5) normal.

Generally headache is a frequent cause of complaint. Symptoms from pituitary and anterior hypothalamic (autonomic nervous system) involvement may be found. Neurologic and roentgenologic examination is usually negative.

Chiasmal arachnoiditis should be differentiated from the demyelinating diseases, toxic neuritis, syphilis, vascular atrophy, and Leber's disease.

Chiasmal arachnoiditis is a disease of early adult life (20 to 40 years) and occurs more frequently in males than in females (2 to 1).

siae. A discussion of the morphologic, cultural, and staining properties of rickettsiae in general was followed by a more detailed analysis of the ophthalmologic manifestations of these organisms. Viruses, bacteria, and rickettsiae were differentiated.

Animal and human experiments on rickettsial diseases were described with special emphasis on Nagayo's work on tsutsugamushi fever, the characteristic microscopic lesions being: (1) invasion of the endothelial cells of the cornea and (2) abundant nodule formation in the iris, ciliary body, and cornea. The etiology of trachoma (virus or rickettsia) was discussed in detail. The ocular manifestations of human rickettsial diseases were presented, especially in typhus fever.

The conclusions were: (1) A comprehensive review of the literature supports the fact that rickettsiae are different from viruses and bacteria. (2) Coles believes that rickettsiae may cause conjunctivitis in different animals. Johnson has shown that pannus formation in sheep can be caused by rickettsial organisms. (3) Nagayo has experimentally produced the ocular lesions of tsutsugamushi fever in the rabbit with injections of rickettsial organisms into the anterior chamber. (4) The wide difference of opinion as to the viral or rickettsial origin of trachoma may be due to interpretation. Experimental work on humans has been insufficient to draw any conclusions. (5) Of the known human rickettsial diseases, typhus fever causes the most characteristic ocular changes.

## NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

February 1, 1943

DR. ISADORE GIVNER, *presiding*

### THE RICKETTSIAE IN OPHTHALMOLOGY

DRS. H. P. VENABLE and F. J. POLLOCK reviewed the literature on rickettsiae.

### RECURRENT ALTERNATING EXOPHTHALMOS

DR. SIGMUND A. AGATSTON reported the case of a 55-year-old man who was first seen in May, 1942, with unilateral exophthalmos of the left eye and who gave a history of proptosis of the right eye three years previously, clearing up

spontaneously in three weeks. Exophthalmometer readings were: R.E. 20.5 mm.; L.E. 24.4 mm. There was conjunctival chemosis and prolapse, and marked limitation of motion, especially in the sphere of action of the lateral rectus. Pressure over the globe did not elicit pain. Uncorrected vision in each eye was 20/30. Fundus examination revealed senile retinal arteriosclerosis, with slight engorgement of retinal veins and moderate hypertensive changes. The intraocular pressure, pupils, and visual-field studies were normal. General examination disclosed no abnormality other than a blood-pressure reading of 180/120. Urinalysis, blood count and chemistry, and Wassermann reaction were all normal. The allergy clinic reported no special sensitivity. Basal metabolic rate the first time was +37 but a second test showed only +6. X-ray examination of the sinuses revealed: Frontals, well developed and slightly cloudy; ethmoids, cloudy, especially the left; sphenoids, small and cloudy; antra, clear. The antra were irrigated and found clear.

Treatment was directed toward cleansing of the conjunctiva. During three weeks following the first visit, the proptosis spontaneously receded to normal with return to normal motility.

In October, 1942, the right eye became swollen, and the patient showed proptosis and chemosis similar to those seen in the left eye five months previously. Vision was unchanged and exophthalmometer readings were: R.E. 24 mm., L.E. 21 mm. The patient was referred to the Ear, Nose, and Throat Clinic where X-ray studies of the sinuses revealed no change in the picture. A diagnosis of sphenoiditis was made, and the patient was given a course of sulfadiazene therapy. After two weeks the chemosis gradually disappeared, although the exophthalmom-

eter reading was still 23 mm. for the right eye. Ocular motility returned to normal. During the hospital stay there was a constant diurnal spiking of the temperature, which, however, never rose above 100°F.

Retrobulbar inflammation, neoplasm, gumma, thyrotoxicosis, allergy, and arteriovenous aneurysm were ruled out as etiologic factors. Evidence pointed to engorgement of the retrobulbar venous system resulting in swelling of the tissues. This condition seems to be secondary to periodic blocking in drainage of diseased sinuses. This type of exophthalmos has been reported by John E. Weeks and others. This case was seen at the New York Eye and Ear Infirmary.

*Discussion.* Dr. Daniel Kravitz said acute exophthalmos may be due to an inflammatory or toxic reaction, possibly thyrotoxicosis, or from a hemorrhage behind the eyeball. It seemed unlikely that exophthalmos secondary to acute sinus disease would appear acutely, recede, reappear, and again subside, particularly without fever. Exophthalmos due to sinusitis is serious and usually requires operation on the sinus or incision of the orbit with evacuation of pus. The recurrent proptosis in this case might have been due to some form of toxemia.

#### JUVENILE CATARACT IN ASSOCIATION WITH DERMATOSIS (SYNDERMATOGENOUS CATARACT)

DR. DANIEL M. ROLETT presented a case, which was reported in this Journal (1944, April, p. 389):

*Discussion.* Dr. Truman Boyes said the patient in the case reported by Dr. Rolett was in the same age group as those in the three cases he and Dr. McDannald reported in 1942. The cataract that develops in these cases is comparable to the traumatic type, as emphasized by Alan



Woods, who felt that since the crystalline lens and ciliary epithelium are developed from ectoderm, allergens in the aqueous could affect the lens capsule and cause cortical cataract.

Dr. Boyce said these patients have a nervous, unstable background as well as an allergic factor. In practically all of the reported cases the condition occurred in previously normal eyes. The majority are between 12 and 25 years of age, and the lens changes are deep in the anterior and posterior cortex. First, there are grayish-white dots which gradually become confluent and later a mature grayish-white cataract develops. The postoperative results are good, and in his case the cataract was removed with a resultant corrected vision of 20/20. Lens changes in the other eye were rather stationary, possibly due, in part, to general treatment with sedatives and vitamins. Pregnancy did not influence the progress of the cataract.

Dr. Sigmund Agatston said that with Dr. Gartner he reported a few years ago, on the cases of two brothers, Rothmund or Werner's syndrome. These patients were about 50 years old and showed, in addition to marked scleroderma, the characteristics of early aging, stunted growth, and early graying of the hair. Senile cataracts had already developed. He emphasized that this condition may also be seen in older patients.

Dr. Milton Berliner said he had just operated on a patient with syndermatogenous cataract in one eye and bilateral keratoconus. He thought it would be interesting to determine whether there is any association between the two conditions.

#### TRANSILLUMINATION IN EYE TUMORS

Dr. RALPH I. LLOYD read a paper on this subject which was published in this Journal (August, 1943).

#### THROMBOSIS OF THE CENTRAL RETINAL VEIN TREATED WITH HEPARIN

Dr. DANIEL KRAVITZ reported the case of a 54-year-old woman, seen on October 11, 1942, who complained of a sudden reduction of vision to light perception in the right eye. A thrombosis of the right inferior temporal vein with massive hemorrhages in the macular area was present. The patient had advanced vascular sclerosis. The patient received eight daily doses of heparin of 100 mg. each. By November 18th vision had improved to 20/70, and there were no signs of hemorrhages. When last seen on January 17, 1943, the vision was 20/70+ and there were a number of black pigment spots in the area.

Dr. Kravitz felt that heparin has been given in such large doses that untoward effects resulted, such as visceral hemorrhages. These cases have been reported. He felt it unnecessary to prolong the coagulation time beyond 8 to 10 minutes. The patient can be successfully treated while going about his regular business.

Dr. Edward Saskin said these cases prove the value of heparin in central-vein block, stating that this is a practical method of treatment for ambulatory patients. He mentioned several other cases which responded favorably to heparin therapy. Dicoumarin, administered orally, may also be used for these cases. There is a latent period of 36 to 48 hours until its cumulative effect appears. The prothrombin time, normally 20 seconds, can be prolonged to as high as 80 seconds if proper care is not taken. Dangerous and uncontrollable hemorrhages may appear if the prothrombin time exceeds 35 to 40 seconds. Physiologically dicoumarin prevents prothrombin formation, destroys it, or attenuates its action. It may be used in conjunction with heparin by administering the latter intravenously and following

with dicoumarin orally. Prothrombin time should be determined daily. These drugs should be considered in the treatment of central-artery occlusion secondary to thrombosis elsewhere in the body.

Dr. James W. Smith asked whether Dr. Kravitz had figures on untreated cases, or, for comparison, cases treated without heparin. He also asked about the relationship between the interval elapsing from the time of occurrence of the thrombosis and commencement of therapy and the ultimate results.

Dr. Sigmund A. Agatston wished to know how heparin worked. In diabetes with vein involvement and thrombosis, prothrombin time is normal. He wondered how it dissolved a thrombus, how it affected an already thrombosed vein and stated that it would appear that after one or two weeks, if the retina is damaged, recovery could not occur.

Dr. Kravitz said that without treatment the hemorrhages following thrombosis take many months to resolve. In many instances they do not resolve at all. He has never seen a case of complete thrombosis ever get well and has never seen any restoration of vision in partial thrombosis with massive hemorrhages in the macular area. Since enucleation for secondary glaucoma is not unusual, any treatment which will save an eye is worthwhile. He has supervised treatment of a patient in which complete thrombosis had occurred three months previously. The hemorrhages disappeared in a short time, and, though vision was limited to light perception, he felt a possible enucleation was avoided. Heparin either prevents thrombin formation or dissolves the newly formed clots. When a thrombus forms there is an immediate piling up of new thrombus along the course of the vein. Heparin prevents this piling up, and if it dissolves the newly formed clot, there is a better chance of canalization. He has

never seen newly formed blood vessels act as new channels in these cases.

#### ACHROMATOPSIA, A REPORT OF THREE CASES

DR. JOSEPH MANDELBAUM said achromatopsia, or complete color blindness, is a clinical syndrome which includes the symptoms of diminished visual acuity, photophobia, a shift of the visibility curve toward the shorter wave lengths, and ocular nystagmus. The term monochromatism may best be applied to those atypical cases where the other features of photopic vision are retained. With Dr. Samuel D. Lewis, Dr. Mandelbaum studied three siblings of French-Canadian derivation, in whose maternal ancestry the syndrome was transmitted as a simple recessive characteristic. They exhibited all the symptoms of achromatopsia including the shift in visibility curve, which was measured on a Helmholtz color mixer. Their visibility curves closely matched the normal scotopic curve, whose peak is at 510 millimicrons, although photopic levels of illumination were employed, which in normal eyes give a peak at 555 millimicrons. Nevertheless their dark-adaptation curves showed two components, similar to the normal cone and rod curves. This may be explained by one of two suppositions: (1) In the achromatic eye there may be two types of rod cells, adaptation occurring more rapidly in one cell and replacing rapid cone adaptation, which would be a valuable asset, for it would avoid a prolonged period of relative blindness following the exposure to a bright light; or (2) a few cone cells are present in peripheral areas of the retina. These last cells may have been sufficient to take over the visual function during the early period of dark adaptation when the rods are completely inactivated, but too few to affect the visibility curve.

*Discussion.* Dr. Charles Haig felt that

the scotopic form of the visibility curve excludes any possibility of cone function in these cases. The supposition that there are two types of rod cells is more probable. This was his conclusion in a similar case of achromatopsia, where, although the dark-adaptation curve was single and showed only rod function, the intensity-discrimination studies showed two distinct curves. The belief that there were two types of rod cells was confirmed by the presence of a double curve when red light was used, for red light always gives single functions with normal rods and cones.

#### DIPLOPIA FOLLOWING SPINAL ANESTHESIA —PARALYSIS OF LATERAL RECTUS, LEFT EYE

DR. LOUIS R. LANG stated that from a review of the literature it would appear that cranial-nerve palsies following spinal anesthesia are rare. The abducens nerve is the most frequently involved. In a study of 88 cases, Blatt found involvement of the trochlear 4 times, the oculomotor 6, and the abducens 78, 18 of the last named being bilateral. The interval between anesthesia and palsy was 3 to 14 days, averaging 7, and the paralysis cleared up in one week to three months, only rarely lasting longer. The incidence has been placed by various investigators as once in 700 spinal anesthetics.

Several theories have been advanced for the causation of this phenomenon. These include faulty technique (Evans); a mild meningitic reaction (Rolett); hemorrhage (Adams); hypertension of the cerebrospinal fluid (Robay); degeneration of the ganglion cells (Kostor); and cerebral edema. The sixth nerve is particularly susceptible to trauma because of its superficial position in the fourth ventricle, and because of its long and exposed course. The treatment of these cases is conservative, since they clear

up eventually, leaving no sequelae.

Dr. Lang described the case of a man, aged 51 years, who had received 50 mg. of novocaine dissolved in 2 c.c. of spinal fluid as anesthesia prior to hemorrhoidectomy. Nine days later he complained of seeing double, and examination disclosed a paralysis of the external rectus muscle of the left eye. Neurologic examination was otherwise negative, all reflexes being present and active. General physical examination, blood Wassermann test, and urinalysis were negative. The visual acuity was 20/20 in each eye. Pupillary findings, fundus examination, and visual-field studies were normal.

There was no improvement in the patient's condition until almost four weeks later when the left eye could be abducted 2 mm. beyond the midline. Further improvement was rapid and five weeks after the injection diplopia could not be elicited with the red glass.

*Discussion.* Dr. Alfred Kestenbaum said that there are two groups of these cases: one following spinal anesthesia, and the other, less frequent, after simple lumbar puncture. In the cases he observed the paresis commenced five to nine days following puncture and was more or less cured after about six weeks. The mechanism of this condition is not clear; all explanations are hypotheses, as there are no anatomic findings. However, there seems to be a real and important entity consisting of abducens paresis occurring 5 to 12 days after a lumbar puncture and lasting about six weeks. In every case of abducens paresis we should therefore inquire about a recent lumbar puncture and consider it in our diagnosis and prognosis.

Dr. Henry Minsky pointed out that it is worth determining which is the dominant eye in treating tropias and occluding the other for greater comfort.

Dr. Joseph Mandelbaum had two re-

cent cases of this condition in which he used prisms to eliminate the diplopia. The patients preferred this very much to occlusion.

Dr. Frieda Mark said she saw a patient in 1936 with an external rectus paresis following spinal anesthesia and that six years later, when last observed, the patient still had diplopia.

Dr. Lang pointed out that external rectus paralysis after simple spinal puncture is very rare. He had seen one case of diplopia lasting a year after the spinal anesthesia and another one, he stated, was reported to have lasted for 18 months. He said Dr. Kestenbaum suggested giving these patients glasses in which the outer half of the glass in front of the involved eye is occluded, thereby eliminating diplopia in the affected field.

Leon H. Ehrlich,  
*Secretary.*

## SAINT LOUIS OPHTHALMIC SOCIETY

February 23, 1943

DR. CARL BEISBARTH, *president*

### EPIDEMIC KERATOCONJUNCTIVITIS

MAJOR MURRAY SANDERS (MC), by invitation, described epidemic keratoconjunctivitis in all its phases, summarizing its history and extension over the world, as well as the work that was done isolating its virus and the methods used in controlling the disease.

*Discussion.* Dr. Robert A. Moore said it was remarkable that in such a short period of time Major Sanders and his colleagues had been able to recognize the disease, isolate its virus, and prove that this virus was related to the disease. He was particularly interested in the effect of the virus on the body as a whole. He asked if there had been any observation made on the presence or absence of the

virus in the lymph nodes, or if any occlusion bodies had been demonstrated.

Major Sanders answered that it was quite possible that there was a systemic distribution of this virus, although its locus is obviously in the eye. Especially in the New York group, patients complained of considerable malaise; 24 patients were kept from work not because they had corneal involvement but because of general discomfort, malaise, and headaches. Some patients were unable to sleep; some complained of symptoms of rhinitis. In one case the virus was isolated in secretion from the trachea. No occlusion bodies had been demonstrated.

Dr. M. Hayward Post reported that a Chicago ophthalmologist had had the disease and showed considerable improvement in his vision, as well as clearing of the cornea, apparently after taking 10,000 units of vitamin C intravenously daily.

Major Sanders replied that riboflavin, typhoid vaccine, tuberculin, and sulfonamides had all been given without any benefit. He did not know of the effect of vitamin C on the course of the disease, although in the test tube it had no effect on the virus.

Dr. John Green commented upon the possibility of the epidemic having originated in India or in some other Oriental country. He asked if there had been any epidemics of the disease in England and wondered if there was any evidence that the spread of the disease in this country could have been the work of enemy agents.

Major Sanders replied that the epidemic had probably originated in the Orient and spread to the West Coast from there. He said that there was a mild outbreak of the epidemic in London in 1933, and there was one in Germany in about 1935. There was no evidence that the spread of the disease was the work of enemy agents.

Dr. B. Y. Alvis asked if there was any known solution that would discourage the growth of the virus or increase the resistance of the patient to the disease.

Dr. Saunders answered that the virus is rather notably resistant to mild antiseptic solutions but that convalescent serum if given early enough would increase the patient's resistance to the disease. In reply to further questioning Major Sanders said that the incidence of the disease was not affected by age or by sex. In Schenectady there was a ratio of two to one between males and females which exactly equalled the ratio of the two sexes doing the work. He said that the procedure in determining compensation was going to be difficult and could not be determined definitely until the ultimate result of the disease was known. Serum from patients on the West Coast had been tested on patients in the East. In explaining why there had been only 8 cases in 150,000 workers in the Saint Louis area he said that the prompt isolation of the few cases that had occurred had prevented its spread and that perhaps the virulence of the disease is gradually becoming less.

Dr. Robert Moore asked for further information concerning the presence of neutralizing antibodies. How long were they demonstrable after an attack of the disease? Did the virus invade the body in some cases and not in others?

Dr. B. Y. Alvis asked if immunity to this virus could be produced by inoculating with other viruses. He mentioned the effect of smallpox vaccination on herpes of the cornea.

Major Sanders replied that neutralizing antibodies had been demonstrated nine months after infection. In one case with a small palpable lymph gland the titer was still going up at the end of that time. Neutralizing antibodies are frequently not demonstrated unless there had been marked glandular involvement. Apparently in the mild form of the disease the virus does not penetrate the body as a whole.

Major Sanders, in answer to Dr. Alvis, said that there were certain possibilities in treatment by inoculation and that there was no reason why they could not be tried.

James Bryan,  
*Editor.*

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## SCIENTIFIC MEETINGS IN WAR TIME

The eightieth annual meeting of the American Ophthalmological Society, held at The Homestead, Hot Springs, Virginia, on May 29th, 30th, and 31st, was ably conducted by the president, Dr. John Green. The attendance under the circumstances was good, representative of about one half the total membership.

This was, as always, a delightful meeting. Half the daylight hours, during which the sun shone and the temperature was perfect, were spent in recreation, a much-needed rest for the overworked

doctors, who cannot take time off in their home town.

The program was good and included several outstanding papers. Of particular interest to the editor was that of Dr. Algernon B. Reese on "Deep-chamber glaucoma due to the formation of a cuticular product in the filtration angle." Beautiful slides were shown illustrating the laying down of a membrane in the filtration angle, presumably by the endothelium, in the cells of which changes similar to those seen in dystrophia epithelialis corneae were observable. Of importance also was the contribution of Dr.

J. S. Friedenwald and Wilhelm Buschke on "Some factors concerned in the mitotic and wound-healing activities of the corneal epithelium." A method for studying the mitotic activity in corneal epithelium was described, as was the effect of various agents on this activity. The importance of movement of the adjoining cells into the denuded area as compared to the relative activity of cell multiplication was stressed.

New officers elected were Dr. S. Judd Beach, president; Dr. Eugene M. Blake, vice-president; and Dr. Frederick C. Cordes, as new member of the Council. Dr. Walter Atkinson was reelected secretary-treasurer. Dr. Louis S. Green was appointed to take the place of Dr. Sanford R. Gifford, deceased. The Homestead was selected for the next meeting, for which tentative dates of June 4th, 5th, and 6th were set, on the assumption that these would dovetail with those to be chosen for the American Medical Association convention, which is planned for New York, but for which the dates have not as yet been selected.

Shortly after the above meeting had ended, the ophthalmologists were wending their way to Chicago for the meetings of the Association for Research in Ophthalmology and the American Medical Association. The usual transportation and housing difficulties were encountered, but attendance was about 70 percent of the usual. By the fourth day of the American Medical Association meeting more than 7,000 members had registered. For the Research meeting 86 registered. Exceptionally good papers were presented, considering the absence of young workers in the Armed Forces. Since the papers read at the Research meeting will appear in this Journal no comment will be made on them here.

The facilities at the Sherman Hotel for the Section meeting were very good. The

loud speaker functioned satisfactorily and the lantern was operated intelligently. Unfortunately, the weather was hot and the air conditioning absent in the lecture room. This tended to inhibit concentration of attention, but the two first-mentioned factors were of more importance than even the last, and made up for deficiencies of ventilation.

The American Medical Association meeting was opened with the Chairman's Address by Dr. Conrad Berens, who outlined ideals for the preparation for a career as an ophthalmologist. His viewpoint was broad and sound. He touched on some of the controversial points in ophthalmic associations, among other things, recommending a broader point of view in regard to optometry. Dr. William L. Benedict, the guest of honor, gave an interesting illustrated talk on the "Diagnosis of orbital tumors." Encouragement in the treatment of bilateral retinoblastoma with irradiation was given by Drs. Hayes Martin and Algernon B. Reese, who had been remarkably successful with this treatment in the second eye. A further use for eikonic lenses—namely, in high astigmatism and oblique axes—was excellently outlined by Dr. Hermann M. Burian and Kenneth N. Ogle.

A new mydriatic and cycloplegic (dibutoline) was described by Dr. Kenneth C. Swan. It seems to have certain advantages over those routinely used and possibly may be of value in the treatment of anterior-segment inflammations. Its disadvantages were also pointed out. Methods of ophtho-rhinologic surgery for dacryocystitis were outlined—by Dr. Harold Gifford, Jr., from the ocular standpoint and by Dr. Laverne B. Spake from the nasal. Probably each method in the hands of an expert is satisfactory. Unfortunately, there is not sufficient material for all who attempt ophthalmic surgery to become efficient, and



these complicated procedures are chiefly successful in the hands of those who are continually performing major surgical operations.

There was much talk of medical economics and ophthalmo-optometric relationships outside of the meetings, but in executive session the only action taken was to authorize the appointment of a committee of five to consider these matters. It was understood that plans might be presented soon to the membership for their consideration at the next meeting of the Section.

Dr. Frederick C. Cordes was elected chairman, and Dr. Grady E. Clay, vice-chairman for the coming year.

Although protests are frequently voiced against the holding of scientific meetings during this period of essential heavy travel and overcrowding of hotels which are understaffed and which suffer from food and drink shortages, the majority of physicians support the idea that these scientific meetings are of sufficient value to justify them. Certainly, they are more important than are a host of other meetings that keep the hotels in the large cities constantly crowded. It is obvious that unessential travel has never been seriously curtailed. It is equally certain that the Government is not vitally concerned in the matter, otherwise it would not wink at the holding of conventions, which could easily be discouraged by a simple prohibition, if they were thought to be really derogative to the war effort. They do serve a good scientific purpose and afford the doctor opportunity of getting a little release from the enormous strain under which he is working.

Lawrence T. Post.

### PAIN

Pain is essentially a warning of injury or of impending injury, or of threatened

destruction of tissue. To ignore pain is to display either stoicism or such a condition of mental exaltation that pain is temporarily thrust into the subconscious.

Vivid experience of pain occurs in all the higher animals. It is probably shared by the lower animal orders, although lack of voice, or of voice such as reaches human ears, renders us less directly aware of such pain. Questions have been raised as to the existence of something analogous to pain in the vegetable world. Plants certainly display protective reactions to injurious influences, but the problem whether they have what we call feeling is somewhat metaphysical.

Most human beings are relatively lacking in sympathy with regard to pain in the animal world below man, although the reality of such sympathy is vouched for by many passages in ancient and modern literature, as well as in laws and organizations whose purpose is to prevent or punish cruelty to animals.

Sympathy with pain in others depends fundamentally upon our own experience in suffering, and our visualization of what might happen to ourselves under similar circumstances. Capacity for such sympathy must therefore be bounded on the one hand by the degree of our own sensibility, and on the other hand by the extent of our own experience, or at least by the scope of our imagination in regard to what we have learned of the experience of others.

It is impossible for each one of us to know with certainty just what are the sensations of others under given circumstances. Those sensations may be much more severe, or conceivably much less severe, than we should have to face, or ever have faced, under apparently similar conditions.

It is likely that the greater intensity of pain expressed by a few individuals in the presence of what most of us regard as

mild disturbances is not purely imaginary but real, its exaggerations depending upon a pathologic sensibility. A patient usually tolerant to his daily experiences, even to such circumstances as may be capable of causing mental distress, may shriek and writhe during the use of a hypodermic needle, whereas other individuals, far from robust, show themselves quite phlegmatic to so trivial an injury.

At such a moment the more sensitive individual may actually sustain a torture beyond his power of philosophic endurance. In other persons there is no philosophy of endurance, but a riotous and unreasoning fear and imagination of physical torment. As to the sensation of pain, just as in many other phases of life, certain persons never grow out of their childhood. On the other hand, some adults who have never ceased being children in other respects will display remarkable fortitude with regard to pain.

It must be remembered that two individuals, apparently intelligent, healthy, and vigorous, may vary greatly as to innate sensibility. Even in the presence of equally excellent visual acuity, one person may show a surprising sharpness of response to tests for minute fractions of astigmatism, while another person may prove tantalizingly incapable of discriminating as to astigmatic fractions quite readily apprehended by the ordinary run of patients.

In like fashion, it is probably true that some patients are definitely made more comfortable by correction of astigmatism down to eighth-of-a-diopter differences, especially where the balance between the two eyes is concerned, although other patients may be utterly insensitive to uncorrected errors of a half diopter or more. It is even conceivable that very rare individuals are capable of experiencing eyestrain from astigmatic differences of less than an eighth diopter. Who shall

venture to set arbitrary limits to sensibility? Variations in sensibility are well illustrated in the field of aniseikonia, where small size differences are apparently much more important to some patients than are much larger size differences to others.

To the physician the significance of pain is most widely found in the field of diagnosis. Much has been written on this subject from a more or less philosophic point of view. The course of lectures first published three quarters of a century ago by Mr. John Hilton, Clinician at Guy's Hospital, London, under the title of "Rest and pain" is rightly regarded as a medical classic. Another book combining wide experience with the shrewd observations and intuition of a medical master mind is that recently issued from the pen of Walter C. Alvarez, of the University of Minnesota and the Mayo Clinic, entitled "Nervousness, Indigestion, and pain."

Hilton's famous work was designed especially to give his surgical students and other readers an understanding of the relationship between anatomic details and symptomatology. Alvarez' volume is described by the author in his preface as "a different sort of book—one which deals more with sick unhappy persons than with their diseases . . . more with the handling of patients than with the giving of medicines . . ."

In the daily practice of ophthalmology, the greatest amount of time is commonly devoted to the measurement of refractive errors. The patient may complain merely of poor vision, but in many cases the history includes complaint of pain or discomfort.

The ophthalmologist does well to obtain and record personally the history of the patient, for only in this way can he establish that personal relation between physician and patient which is the basis

of good medical practice. By cross-examination he may learn important details as to the patient's daily activities, including the time of day at which the pain or discomfort usually develops. He will at times suspect that headache is not ocular in origin. Headache in the early hours of the morning, for example, may occasionally depend upon use of the eyes during the evening hours, but it is sometimes due to vasomotor reactions in the nose and accessory sinuses, and these reactions may be connected with draughts or changes of temperature in the sleeping quarters toward morning.

One should carefully investigate symptoms of an apparently migrainous character, bearing in mind that headache may have a migrainous basis without manifesting all the typical elements of the migraine syndrome. Instead of presenting the preliminary scotoma scintillans, followed by headache, dizziness, nausea, and vomiting, a migrainous patient may experience only a scotoma, or may have the scotoma followed by headache, or headache without scotoma or nausea, or headache and nausea without other symptoms.

Migraine commonly represents an inherited nervous tendency for which there is no complete and final cure. Yet in some patients it may either be cured, or at least greatly lessened in frequency and severity, by removal of an important exciting cause. Some very definite cases of migraine are actually cured by an accurate refractive correction, while in others the refractive correction gives the patient some, although incomplete, relief from the attacks.

When dealing with a history of migraine, the ophthalmologist may often render valuable service as a psychoanalyst. The migrainous patient is usually a person with keen sense of responsibility, whose busy days are crowded with many tasks, each of which is a "trouble met halfway." The patient needs to learn that

to undertake these successive tasks and responsibilities with the greatest possible efficiency and the least possible waste of nervous energy he should devote himself to the thing in hand without worried consciousness of what has already been done or of the mountain of jobs that remain to be accomplished. It is also useful to suggest a general attitude of muscular relaxation of those parts of the body not concerned in the activity of the moment.

The patient may need to be advised of the destructive effect of that form of mental perturbation which arises from irritation against the task, against other persons, or against the patient himself on account of dissatisfaction as to the degree of his own efficiency in action or in personal relationships. In other words he must cultivate concentration without tension. The lesson will of course be more effective if the physician himself displays the attitude which he seeks to inculcate in his patient.

Even the ophthalmologist, puzzled by neuro-ocular symptomatology for which he has found apparently inadequate explanation, may profit at times by realizing the expediency of inquiring delicately into the existence of secret problems which more than physical causes plague the life of his patient.

While in many of our nervous patients the necessity for working without tension, and without emotional frictions, is of great significance, we ought never to overlook the fundamental importance of rest. Many ocular irritations are decidedly increased by lack of sufficient sleep. The senile or presenile patient who believes himself capable of working just as hard and just as continuously as he did many years ago will last longer and accomplish more if he learns to go more slowly and to rest from his labors more frequently than was perhaps necessary in his earlier days.

Balanced judgment as to the meaning

of the pain symptom is of particular importance in dealing with malingering. In a case of injury where insurance or industrial compensation is involved, a complaint of pain exaggerated beyond the evidence of actual damage to the organ of vision is always suggestive of intent to deceive. The workman who shows no inflammation or destruction in the anterior segment of the eye, yet persistently complains of pain and distress on exposure to light, and insists on squeezing the eyelids together during examination, is wholly or partly malingering.

As opposed to the general fact that pain is a warning, we are faced by a group of conditions in which pain is entirely absent, at least in the earlier stages of the disease. This is true of some malignant tumors, whether superficial or deep. The pain produced by deep-set conditions is commonly reflex in character, the deeper tissues being relatively poor in direct sensibility. Pain gives us no direct warning at all with regard to changes in the optic nerve, retina, or choroid. The most tragic example of this absence of warning is simple glaucoma, in which the patient may go along for years without pain and perhaps regarding his gradual loss of sight as something proper to his declining years and in which no treatment is indicated or would avail.

In some surgical cases our estimate of the importance of pain or its absence will depend partly upon our previous experience of the individual, partly upon other ocular symptoms. To the patient who has an exaggerated sensibility we must often make light of his pain. But some patients must be coaxed to acknowledge pain, and we must occasionally be on our guard against trusting the phlegmatic patient

who confesses no pain, for the lack of this symptom may serve to mislead us.

W. H. Crisp.

## BOOK NOTICE

YOUR EYES. By Sidney Fox, Sc.M. (Ophth.), M.D. Clothbound, 191 pages exclusive of index; illustrated. New York, Alfred A. Knopf, 1944. Price \$2.75.

This book is the best of recent publications about the eye for laymen. It has the double virtue of being informative and interesting. The material is well arranged and handled with a light touch. Starting with some physiology, the author progresses through Causes for poor vision, Presbyopia, and History of eye glasses. The subject of Color vision is treated in an entertaining manner. This leads naturally to comments on Color lenses. The Eye muscles come in for a brief chapter, the Eye in traffic occupying somewhat more space.

An attempt is made to take the headache out of the ophthalmologist-optometrist relationship. To one who has had to explain the differences between oculist, optician, and optometrist daily for 30 years there seems little hope that the public, no matter how well approached, will ever make the discrimination.

Quackery is discussed in a short chapter. A consideration of the eye of youth and of old age finishes a book that may suitably be recommended for lay consumption. There is not much material that will be new to the ophthalmologist, although he will have an enjoyable hour in glancing through it.

Lawrence T. Post.

# ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

## CLASSIFICATION

- |  |  |
|--|--|
| 1. General methods of diagnosis                        | 10. Retina and vitreous                                |
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| 9. Crystalline lens                                    | 18. Hygiene, sociology, education, and history         |
|  | 19. Anatomy, embryology, and comparative ophthalmology |

### 5

#### CONJUNCTIVA

Arruga, H. *Conjunctivitis sicca*. Arch. de la Soc. Oft. Hisp.-Amer., 1943, v. 2, Jan.-Feb., pp. 68-71.

The condition occurs mostly in females between 25 and 60 years of age. The symptoms are dryness, feeling of sand in the eyes, photophobia, and impaired vision. The conjunctiva is thickened, red, and dry, and there is a ropy discharge. The cornea is frequently involved, showing a filamentous keratitis. Often there is associated dryness of the pharynx and larynx and swelling of the parotid glands. The ocular disturbance is due to lack of tears, the cause for which usually cannot be determined. A few cases are due to extirpation of the lacrimal gland, dacryoadenitis, or fracture of the base of the skull. Ovarian dysfunction is thought to be the cause of some cases. No treatment is effective except permanent closure of the puncta by galvanocautery.

J. Wesley McKinney.

Belmonte Gonzalez, J. *Conjunctival reaction to low temperatures in persons not accustomed to extreme cold*. Arch. de la Soc. Oft. Hisp.-Amer., 1943, v. 2, Jan.-Feb., pp. 77-78.

Thirty to forty percent of the Spanish soldiers serving with the Blue Division (in Russia) suffered from an evanescent conjunctival inflammation which cleared up in a few hours with or without treatment when the individual was brought indoors or when the weather became less cold.

J. Wesley McKinney.

Castellanos, L. *Ariboflavinosis as a probable cause of vernal conjunctivitis*. Arch. of Ophth., 1944, v. 31, March, pp. 214-216.

The author believes the cause of vernal conjunctivitis is a deficiency of riboflavin, the deficiency being due to more rapid destruction of the vitamins by the ultraviolet rays of sunlight or to the demand for a greater quantity of this vitamin during the hot season. Kreibich and Dimmer have expressed the opinion that vernal conjunctivitis

is caused by solar rays, and have compared it to pellagra and other vitamin-deficiency dermatoses.

The author claims that 92 percent of 105 patients treated were improved. The treatment consisted of administering during the hot season of the year one to three tablets of riboflavin, 1 mg. each (containing 400 Sherman units). Also prescribed were a few drops of a solution of 0.05 gm. of tetracaine hydrochloride and 15 drops of epinephrine hydrochloride (1 to 1,000) in 5 c.c. of distilled water, the solution to be used only when the symptoms became accentuated. The patient was advised to drink as much milk as possible, because of its riboflavin content. Under the treatment described, 35.7 percent of those treated are said to have shown improvement in all ocular symptoms on the third or fourth days; and 65.1 percent to have improved in from ten to fifteen days. The other nine patients did not return for examination. (References.) R. W. Danielson.

Derrick, E. H. Swimming-bath conjunctivitis, with a report of three probable cases and a note on its epidemiology. *Med. Jour. Australia*, 1943, v. 2, Oct. 23, pp. 334-336.

Outbreaks of conjunctivitis among bathers have been described in Europe and America. Many of the cases are examples of a specific disease a characteristic feature of which is the presence of inclusion bodies in the epithelial cells of the inflamed conjunctiva. These are colonies of the causative virus and consequently the disease is often called "inclusion conjunctivitis" or "inclusion blennorrhoea." It is caused by a filter-passing virus, and ends in resolution. After an incubation period of three to four days, it starts unilaterally, the other eye is affected two to

three weeks later, and the acme is reached in three to four days. The bulbar conjunctiva is relatively unchanged. In seven to ten days follicles appear, the inflammatory symptoms die out in from three to four weeks, in four to six months the condition resembles folliculosis, and the follicles slowly disappear. Thygeson and Stone state that the oral use of sulfanilamide cures this form of conjunctivitis rapidly.

Three cases are reported, in boys aged 12, 8, and 8 years respectively. The history is almost the same in all cases. The boys had spent several hours in a swimming bath on November 14, 1942. The first boy was affected on November 21st. The conjunctiva of the left eye became rapidly red, with swollen lids, while the cornea was not affected. The next day general symptoms started, with high temperature which lasted for five days, subsiding then by rapid lysis. A month later there was a marked bilateral folliculosis. In the second boy the left eye was affected severely first, and then slightly the right. The third case had both eyes affected. Symptomatology and diagnosis, and also chlorination of water, are discussed. (References.)

M. Lombardo.

Pelayo, M. Diagnosis of afollicular trachoma. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1943, v. 2, Jan.-Feb., pp. 79-84.

The three cardinal symptoms of trachoma are granulations, pannus, and conjunctival cicatrices. The diagnosis is more or less certain if any one of these symptoms is present. There are a few cases wherein apparently only a mild conjunctivitis exists. In view of the importance of trachoma as regards contagion the author advises careful examination of the upper fornix. Of

diagnostic importance is the finding of fine scarring and even symblepharon in the upper fornix.

J. Wesley McKinney.

## 6

### CORNEA AND SCLERA

Bloomfield, Sylvan. The use of tyrothricin, a bacterial extract, in the treatment of marginal ulcers of the cornea. *Amer. Jour. Ophth.*, 1944, v. 27, May, pp. 500-504. (References.)

Lee, O. S., and Hart, W. M. The metabolism of the cornea. *Amer. Jour. Ophth.*, 1944, v. 27, May, pp. 488-500. (6 figures, 7 tables, references.)

Pallinger, B. D., and Mann, I. Avascular healing in the cornea. *Jour. Path. and Bact.*, 1943, v. 55, April, p. 151.

Avascular healing of the cornea in lesions caused by chemical burns was studied in rabbits. This occurred if the corneoscleral junction was uninjured and free from edema. During healing there was invasion of the substantia propria by wandering cells in far greater number than usually seen. Evidence was found that some of these cells act as macrophages, while others are transformed into keratoblasts and fibrocytes. A transformation of others into corneal corpuscles seemed probable.

T. E. Sanders.

## 7

### UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Graham, Colin. Atophanyl in the treatment of sympathetic ophthalmia. *Canadian Med. Assoc. Jour.*, 1944, v. 50, Feb., p. 156.

The author reports the fortunate outcome of a very severe case of sympathetic ophthalmia in a male aged 19

years treated with injections of atophanyl. Infected teeth and tonsils were removed. Despite a white eye with normal corrected vision, tuberculin injections were continued in the presence of a positive Mantoux reaction.

F. M. Crage.

Páez Allende, F. Aniridia. *Anales Argentinos de Oft.*, 1943, v. 4, April-May-June, pp. 65-68.

A six-year-old boy presented numerous congenital defects of the eyes and adnexa. The antecedents were normal. The eyebrows met on the dorsum of the nose, the left palpebral fissure was narrower than the right, microcorneas with embryotoxon were present, there were small pigment spots on the lens capsule, and posterior cortical opacities were seen. The irises were apparently totally lacking and the zonular fibers were visible. The vision was 1/10 in each eye. (References.)

Eugene M. Blake.

Wurster, H. C. Sympathetic ophthalmia. *Jour. Indiana State Med. Assoc.*, 1944, v. 37, March, pp. 130-135.

Eight weeks after a perforating wound of the left eye and two operations, sympathetic uveitis developed in the right eye. The injured eye was then enucleated, but the right eye ultimately degenerated. A brief summary of the etiology, diagnosis, and treatment, culled from several current books and journals, follows. Charles A. Bahn.

## 8

### GLAUCOMA AND OCULAR TENSION

Harrington, D. O. A new impression tonometer. *Trans. Pacific Coast Oto-Ophth. Soc.*, 1942, v. 27, pp. 145-149.

The author defines a tonometer as an instrument for measuring ocular im-



pressibility by depth of indentation produced with a given force over a constant area of the cornea. Noting that about fifty different instruments have been devised for measuring intraocular pressure, he urges correlation and standardization of instruments and scales of pressure, based entirely on terms of actual intraocular pressure as suggested by Friedenwald. The writer's new impression tonometer is said to meet the experimentally proved and accepted fundamental Schiötz specifications. Lawrence G. Dunlap.

Kronfeld, P. C. Indications for paracentesis of the anterior chamber. *Jour. Indiana State Med. Assoc.*, 1944, v. 37, March, pp. 113-116.

In glaucomas secondary to uveitis, except when associated with iris bombé, paracentesis is indicated after conservative methods have failed. It should not be done more than twice. In some progressive corneal ulcers, emptying of the anterior chamber causes the cornea to become less convex, favoring healing. By interfering with closure, the anterior chamber may be kept draining for three weeks. The same is true in some cases of nonsuppurative, nonnecrotizing, nonsyphilitic deep keratitis. In chronic uveitis without ciliary injection, paracentesis may favor healing by removing the blood-aqueous barrier. Paracentesis is of little or no value in narrow-angle glaucomas, in wide-angle glaucomas of the chronic simple type, or in glaucomas secondary to obstruction of retinal veins. Paracentesis may be performed with a hypodermic needle, a paracentesis knife, or a keratome. A slightly ragged incision favors longer drainage. Its effect on intraocular tension is: (1) an initial drop, (2) a restoration, (3) the hypertensive phase, (4) the hypoten-

sive phase. In nonglaucomatous eyes the canal of Schlemm is filled with blood after paracentesis until the intraocular tension reaches about 15 mm. mercury. Surgical removal of hyphæ should be done only in cases of severe ocular contusion with rapid hypertension. Charles A. Bahn.

9

CRYSTALLINE LENS

Carreas Duran, B. Heterophoria and surgical aphakia. *Arch. de la Soc. C. Hisp.-Amer.*, 1943, v. 2, Jan.-Feb., pp. 52-55.

When cataract extraction has been delayed one or more years in the second eye, the presence of diplopia occasionally mars an otherwise happy result. The heterotropia found in this situation was latent in the individual before cataract extraction and becomes manifest as a result of prolonged interference with the fusion faculty by the poor vision of one eye. The author advises that, when heterophoria is demonstrated by the ordinary test during the stage of incipency, the interval between cataract extraction in the two eyes be as short as possible.

J. Wesley McKinney.

Castro Basto, R. A. de. Extraction of cataract in its capsule. *Med. Jour. Australia*, 1943, v. 2, Oct. 16, pp. 311-315.

The writer discusses extracapsular and intracapsular methods, with analysis of 40 operations, 35 being total extractions of which 31 were performed on women. The visual results were as follows: 6/5 in 2 cases, 6/6 in 17 cases, 6/9 in 3 cases, 6/12 in 6 cases, 6/15 in 6 cases, 6/21 in 2 cases each, 6/24 and less in 2 cases. Vitreous prolapse occurred in 2 cases, iris prolapse in 2, detached ch-

roid in one, intraocular hemorrhage in one.  
M. Lombardo.

Gill, E. G., and Gressette, J. H. Recent advances in intracapsular cataract surgery. *Virginia Med. Monthly*, 1943, v. 70, Oct., p. 501.

The authors state that the technique described has given them uniformly good results. The article is accompanied by six illustrations of the various steps in the technique. Using silk sutures in the lid and under the superior rectus muscle, the eye speculum need not be used. This allows the surgeon to close the eye quickly without removing the sutures. The conjunctival flap is made and sutures placed before the keratome incision. The keratome incision is enlarged with scissors. Using a central suture for traction the iris is brought clearly into view. Iridectomy can be done carefully and deliberately, and the coloboma can be inspected. By use of the traction suture the lens can be seen the moment it presents itself in the wound, and the Verhoeff capsule forceps can be placed accurately, the lens being grasped at the equator. In the author's experience, astigmatism with this type of incision has been one fourth to one half less than with the Graefe-knife incision.

Theodore M. Shapira.

Neblett, H. C. Bilateral cataract from electrical shock? *Southern Med. and Surg.*, 1944, v. 106, May, p. 12. (See Section 16, Injuries.)

Reese, A. B. Congenital cataract and other anomalies following German measles in the mother. *Amer. Jour. Ophth.*, 1944, v. 27, May, pp. 483-487. (References.)

Robbins, B. H. Dinitrophenol cataract: production in an experimental

animal. *Jour. Pharmacol. and Exper. Therapeutics*, 1944, v. 80, March, pp. 264-267.

Dinitrophenol produces cataracts in man and fowls, but not in rats, rabbits, guinea pigs, and dogs. After four to six hours, faint anterior cortical lens opacities appear in chickens and ducks which have been on a diet containing 0.25 percent 2:4 dinitrophenol sodium. In 24 hours, the opacities extend over the anterior lens, and somewhat later they involve the posterior portion. The nucleus is usually not involved. With lower concentrations, the opacities are delayed or absent. The earliest lens changes are finely granular dots and vacuoles which later involve several lens fibers at different levels. Intramuscular injection of riboflavin previous to the administration of dinitrophenol does not alter the development of lens opacities. Other nitrophenols act similarly to the dinitro compounds. Dinitrophenol opacities in fowls resemble histologically those similarly produced in man.

Charles A. Bahn.

## 10

### RETINA AND VITREOUS

Dienst, E. C., and Gartner, S. Pathologic changes in the eye associated with subacute bacterial endocarditis. *Arch. of Ophth.*, 1944, v. 31, March, pp. 198-206.

Subacute bacterial endocarditis is a complication of heart disease which is often brought to the attention of the ophthalmologist because of the striking fundus picture. From the irregular vegetations on the edges of the valves, bacteria and emboli break off and enter the blood stream. The eye is particularly vulnerable to their attack.

The retinal lesions are characteristic. The retina often presents a cloudy ap-

pearance, various types of hemorrhage, small white Roth-Litten spots, occasionally large retinal exudates, and sometimes papillitis and embolism of the central retinal artery. Peculiarly, there is little visual impairment in cases of papillitis, which fact the author explains by saying that the process in these cases is mainly edema instead of cellular infiltration.

In addition to the retinal lesions, there are usually many choroidal infiltrations. Furthermore, examination with the slitlamp may show small floating cells in the anterior chamber and fine keratitic precipitates. (5 case reports, 11 figures, references.)

R. W. Danielson.

Palomar, A. On juvenile recurrent hemorrhages in the vitreous. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1943, v. 2, Jan.-Feb., pp. 25-44.

Six cases of this disease were presented in detail. Two were associated with active pulmonary tuberculosis. In one a new hemorrhage followed a tuberculin injection. One was thought to be due to focal infection of dental origin. One was a proved case of Buerger's thromboangiitis. In one no definite etiologic factor could be determined. The cases studied led the authors to the conclusions that tuberculous periphlebitis is the cause of recurrent retinal hemorrhages of the juvenile type (Eales's disease); that an occasional case may be due to focal infection although definite causal relationship cannot be shown; and that thromboangiitis obliterans is a rare cause of the condition.

J. Wesley McKinney.

Sellas Garriga, J. A case of angiomatosis retinae. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1943, v. 2, Jan.-Feb., pp. 18-24. (See Section 15, Tumors.)

Spaeth, E. B. Traumatic liporrhagia retinalis (Verhoeff). *Arch. of Ophth.*, 1944, v. 31, March, pp. 191-197.

In addition to providing a monographic bibliography, the author aims in this article to obtain a more satisfactory explanation of the pathologic changes in the eye and to determine the mechanical basis of the retinal hemorrhages. Purtscher had originally postulated that the pathology was due to the forcing of cerebrospinal fluid under increased pressure through the perineural-perivaginal lymph spaces. The author takes up the arguments against this theory and then presents the case for the theory that the condition is primarily due to fat emboli from traumatized bone marrow.

He feels that Verhoeff's term, "liporrhagia retinalis traumatica," should be adopted. The ophthalmoscopic picture is characterized by somewhat generalized diffusion of fat droplets in the fundus and by a generalized hemorrhagic appearance in the retina or brain or both, due to factors other than the emboli themselves. There is probably a severe disturbance of the venous circulation in the retina, brain, and brain stem. (One color plate, 2 case reports, bibliography.)

R. W. Danielson.

# 11

## OPTIC NERVE AND TOXIC AMBLYOPIAS

Costi, C. Retrobulbar neuritis of hypophyseal origin. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1943, v. 2, Jan.-Feb., pp. 90-97.

A case of pituitary tumor showed pressure signs in both optic nerves. Deep X-ray therapy caused shrinkage of the tumor and restoration of normal fields and vision.

J. Wesley McKinney.

## 12

## VISUAL TRACTS AND CENTERS

Adler, Alexandra. Disintegration and restoration of optic recognition in visual agnosia. *Arch. Neurol. and Psych.*, 1944, v. 51, March, pp. 243-259.

In the tragic fire which occurred in the Cocoanut Grove night club of Boston, in 1942, a patient aged 22 years received slight skin burns. She had permanent effects of carbon-monoxide poisoning. Her inability to recognize the import of visual stimuli was apparently due to a bilateral lesion in the occipitoparietal cortex. The author describes in minute detail the patient's basic condition and her clinical progress, and gives a résumé of the pertinent literature. The patient's permanent vision (apparently uncorrected) was about 20/70, and the visual fields were approximately normal. At the end of a six-months observation period only parts of the whole were perceived and their collective relationships were not recognized. This caused inability to read, to copy letters and geometric figures, or to recognize pictures. Writing was practically unimpaired. Preceding optic impressions superimposed themselves on subsequent ones, interfering with proper perception and recognition. Apparently, the different symptoms of optic agnosia do not have separate localizing significance. Constant practice at building up new methods of visual recognition is the essence of treatment.

Charles A. Bahn.

Agatston, Howard. Ocular malingering. *Arch. of Ophth.*, 1944, v. 31, March, pp. 223-231. (See Section 1, General methods of diagnosis.)

Costi, C. Retrobulbar neuritis of hypophyseal origin. *Arch. de la Soc. Oft.*

*Hisp.-Amer.*, 1943, v. 2, Jan.-Feb., pp. 90-97. (See Section 11, Optic nerve and toxic amblyopias.)

D'Eramo, C. Traumatic, bilateral, hysterical amaurosis. *Anales Argentinos de Oft.*, 1944, v. 4., Jan.-Feb.-March, pp. 18-22.

A 24-year-old laborer, covered by compensation insurance, received in the frontal region a blow of moderate severity. He complained of poor distant vision, which soon progressed to complete blindness. The fundi were normal and X rays of the skull were negative. After the patient had been assured that a painful injection in the temple would cure his blindness, a hypodermic of novocaine was given, and this was repeated twice, on successive days. On the fifth day of treatment vision was 20/20. This was the second episode of hysterical blindness in the same patient within two years. Abstracts of similar cases are appended, and a consideration of the mental processes of subjects of hysteria is offered. (References.)

Eugene M. Blake.

Latorre Morasso, S. Chiasmatic syndrome with oculomotor alterations. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1943, v. 2, Jan.-Feb., pp. 98-103.

A case of pituitary tumor showed erosion of the posterior clinoids, partial paralysis of all the extraocular muscles on the right side, amaurosis of the right eye, partial temporal anopsia in the left eye, and diabetes insipidus.

J. Wesley McKinney.

Mata Lopez, P., and Solis, J. Observations in a case of pituitary adenoma. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1943, v. 2, Jan.-Feb., pp. 104-110.

A case of presumed basophilic ade-

noma of the pituitary is reported and discussed. J. Wesley McKinney.

Raaf, John. The perimetric diagnosis of intracranial tumors. *Trans. Pacific Coast Oto-Ophth. Soc.*, 1942, v. 27, pp. 131-144. (See Section 1, General methods of diagnosis.)

Voisin, Jean. Bitemporal hemianopsia in cranial fractures. *Jour. de Chirurgie*, 1942, v. 58, Sept.-Dec., pp. 404-417.

With the statement of an individual case recently observed, the author associates a general discussion of the subject. Bitemporal hemianopsia in such cases is of great rarity, of debated prognosis, and of uncertain pathogenesis. Bollack's memoir in 1920 assembled 17 cases, and Voisin has only been able to find forty cases in the literature.

Cases of injury in which bitemporal hemianopsia might occur are often fatal and probably have often passed unrecognized, the importance of a study of the visual field being often overlooked. The X-ray examination often lacks precision as to the nature of the fracture and its radiations. Voisin found indication of symmetry of the two visual fields, although sometimes with slight irregularities, in seven or eight out of the forty recorded cases. In 13 cases the field defect avoided the macular area, while in eight cases it involved the point of fixation. In four cases it reached the macular area on one side and spared the other macula. In one case there was a seeing island inside each of the otherwise blind temporal fields. The visual acuity was usually reduced on both sides. After the first few weeks, there was almost always a papillary atrophy, although two cases showed normal discs after two and four months respectively.

The author is disposed to attribute to microscopic rupture of the fibers of

the chiasm the immediate hemianopsias; and to a traumatic optochiasmatic arachnoiditis the secondary hemianopsias.

The single new case described occurred in a woman of 29 years, who on August 28, 1940, attempted suicide by throwing herself from the second floor. When she recovered from the primary lethargy and became accessible to an eye examination, she showed bitemporal heteronymous hemianopsia. The visual acuity of each eye with correction was 4/10. There was crossed diplopia when the eyes were turned to the right, the optic discs had recovered from an earlier slight edema, and the Wernicke hemiopic reaction was positive. (5 sets of fields.) W. H. Crisp.

### 13

#### EYEBALL AND ORBIT

Fagin, I. D., Pagel, R. W., and Sand, H. H. Exophthalmic ophthalmoplegia. *Amer. Jour. Ophth.*, 1944, v. 27, May, pp. 504-514. (4 illustrations.)

Goetzman, A. C., and Friedman, R. Cavernous-sinus thrombosis with recovery. *Amer. Jour. Ophth.*, 1944, v. 27, May, pp. 523-524.

Means, J. H. The nature of Graves's disease with special reference to its ophthalmic component. *Amer. Jour. Med. Sciences*, 1944, v. 207, Jan., pp. 1-19.

The author presents an excellent view of the ocular signs and symptoms of Graves's disease, stressing the relation of the disease as a whole. The pathogenesis of the eye signs is discussed in detail. He stresses the importance of the ophthalmic components of the disease in understanding the proper management of the condition.

T. E. Sanders.

Moreu, A. Concerning a case of aneurysm of the internal carotid in the cavernous sinus of traumatic origin. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1943, v. 2, Jan.-Feb., pp. 111-119.

A detailed case report with short discussion.

Poppen, J. L. Exophthalmos. Diagnosis and surgical treatment of intractable cases. *Amer. Jour. Surg.*, 1944, v. 64, April, pp. 64-79.

The most frequent causation of 43 cases of bilateral and 44 of unilateral exophthalmos seen in the Lahey Clinic between 1933 and 1944 was: bilateral: thyroid disease 28, hypertension 5, brain tumor 4; unilateral: sphenoid-wing meningioma 11, cholesteatoma 3, osteoma 3. Decompression of the orbital roof, basically as described by Naffziger, was successfully performed on 26 of 28 patients. The indication is exophthalmos with progressive visual changes in the cornea, fundus, or ocular muscles after thyroid operation. Exophthalmos may not develop proportionately to the thyroid disturbance, and it may recede very slowly after operation. The Hertel exophthalmometer was used and was considered of marked value. Extraocular paresis was frequent, and often did not entirely disappear after operation. In avoiding orbital decompression, thyroid medication, Lugol's solution, and bilateral cervical sympathectomy were of no value. The quantity and quality of brawny orbital infiltration were considered important in the prognosis and advisability of orbital decompression. This information is judged by the resistance of the eyeball against the orbital tissues upon pressure through the lids. The operation performed in the unilateral cases is not described in this contribution, having been presented in another

article. Conservative methods are not justified when the safety of the eyeball is questionable.

Charles A. Bahn.

Puga, Ruy. Restoration of the inferior fornix by freeing the lid. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1943, v. 2, Jan.-Feb., pp. 85-89.

A method is presented for restoring an inferior fornix capable of holding a prosthesis following scar contraction subsequent to enucleation. In order to disturb the scar tissue as little as possible and thus avoid further contraction, an incision is made on the posterior surface of the lid 1 mm. from the border, from one end of the lid to the other. The incision is made through the tarsus and is carried down its external aspect and beyond to the orbital rim. The cut edge of the tarsus is brought down to the orbital rim and anchored in this position by doubly-armed sutures passed through the lid and tied on the skin surface. The posterior surface of the lid is then covered with buccal mucous membrane. Good results are reported in two cases.

J. Wesley McKinney.

Soley, M. H. Exophthalmos in diseases of the thyroid. *California and Western Med.*, 1944, v. 60, Feb., p. 64.

Exophthalmos in thyroid disease is discussed. Using the Hertel exophthalmometer, exophthalmos before and after treatment was measured in 332 thyroid patients. The greatest exophthalmos was produced by toxic diffuse goiters; toxic nodulars were next, and the nontoxic nodulars produced no exophthalmos.

After treatment, 40 percent of those with toxic diffuse or toxic nodular goiters showed progression of exophthalmos following subtotal thyroidec-

tomy, while only 13 percent of those treated by X ray showed progression. Only a very few had any regression following therapy of any type. It is suggested that 5 to 7 grams of thyroid tissue be left in situ when thyroidec-tomy is performed on a patient with tendency to exophthalmos, instead of the usual 3 to 4 grams.

Robert N. Shaffer.

Thornhill, E. H., and Anderson, B. Extradural diploic epidermoids producing unilateral exophthalmos. *Amer. Jour. Ophth.*, 1944, v. 27, May, pp. 477-483. (3 illustrations, references.)

#### 14

##### EYELIDS AND LACRIMAL APPARATUS

Ellis, O. H. A combined ptosis operation. *Trans. Pacific Coast Oto-Ophth. Soc.*, 1942, v. 27, pp. 159-166.

The author presents a combined procedure for correction of ptosis, based chiefly on the Motais operation, which utilizes a strip of the superior rectus tendon when that muscle has normal action. He recalls Jameson's statement that as much as one half of the superior rectus muscle may be used without endangering its function. The technique is detailed. This operation, like the Dickey operation, is simpler than the original Motais.

Lawrence G. Dunlap.

Mata López, P. Two cases of mycotic blepharitis due to *Trichophyton*. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1943, v. 2, Jan.-Feb., pp. 62-67.

Two cases of long standing blepharitis were shown by culture to be due to *Trichophyton cerebris*. Saboureaud's medium was used for the culture. It was thought that the infection had been acquired from a domestic animal.

Tincture of iodine painted on the lid margins is specific for the infection. The possibility of trichophyton infection should be kept in mind in those cases of blepharitis which do not respond to the usual treatment.

J. Wesley McKinney.

Zeno, Lelio. Hypertelorism associated with median nasal fissure. *Anales Argentinos de Oft.*, 1944, v. 4, Jan.-Feb.-March, pp. 3-5.

After discussing the occurrence and development of bifid nose and the occasional association of hypertelorism with this defect the author describes a case in a young girl. To correct the depression in the nose a piece of vitalium was inserted under the skin. This also corrected the incidental epicanthus and made the wide separation of the eyes less apparent. (2 illustrations, references.) Eugene M. Blake.

#### 15

##### TUMORS

Davis, W. T., Sheppard, E., and Romejko, W. J. Leiomyoma of the iris. *Amer. Jour. Ophth.*, 1944, v. 27, May, pp. 467-469. (2 color plates, references.)

Flick, J. J. Tumor of the lacrimal gland. *Amer. Jour. Ophth.*, 1944, v. 27, April, pp. 362-368. (5 figures, references.)

Iles, A. E., and Short, A. R. Orbital tumors. *Brit. Jour. Surg.*, 1943, v. 31, Oct., pp. 147-150.

The 14 orbital tumors reported include four hemangiomas, three cysts, two sarcomas, one carcinoma, one mixed lacrimal tumor, one diffuse lipoma, one tuberculous encysted abscess, and one of unknown pathology. The youngest patient was 18 and the oldest 70 years of age. Very interesting.



were the hemangiomata. Their nature was indicated by a nevoid condition of the lids, the tumor presenting itself as a firm, red, roundish encapsulated mass. Removal by the Krönlein method of such a tumor affecting a patient 70 years old is described in detail. Of the cysts one was a dermoid, another a mucocele of the frontal sinus which had eroded the bony wall.

Of the malignant tumors, an encapsulated sarcoma recurred in the parotid region, a lymphosarcoma had shown no recurrence six months later, and a carcinoma of the lacrimal gland which had been treated with radium a few days after its partial removal had shown no recurrence five years later. None of the cases showed intracranial extension, and in twelve cases a Krönlein operation was performed. Ocular paralyses manifested themselves after the operation in several cases. The authors found the Krönlein method of approach quite satisfactory. In their opinion intraorbital tumors which are located in the outer and lower sections of the orbit are well exposed by the Krönlein method, as are also the tumors within the muscle cone. (2 figures.) Melchior Lombardo.

Reca, A. B. Tumor of the optic nervehead. *Anales Argentinos de Oft.*, 1943, v. 4, April-May-June, pp. 57-62.

A 26-year-old man complained of reduced vision and of a yellowish discoloration of objects, which later appeared smaller than normal. The left eye only was affected and the duration was from one to 1½ years. A reddish mass covered the site of, and extended 2 to 3 disc diameters beyond, the optic disc. General and special examinations revealed no cause for the mass. The actual diagnosis and development of the case are not stated. There follows

a discussion of tumors of the optic nervehead. Eugene M. Blake.

Reeves, R. J. X-ray and radium therapy in lesions about the eye. *North Carolina Med. Jour.*, 1944, v. 5, March, pp. 85-87. (See Section 2, Therapeutics and operations.)

Sellas Garriga, J. A case of angiomatosis retinae. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1943, v. 2, Jan.-Feb., pp. 18-24.

A 17-year-old boy first presented himself in 1923, having casually noticed the day before that his left eye was blind. He was found to have a total detachment of the retina which was attributed to trauma. He returned two years later with impairment of vision in the other eye. Down and out was seen a yellowish-red retinal tumor to which ran an enormously dilated inferotemporal vein and artery. Edema surrounded the tumor and the dilated vessels. A diagnosis of Hippel-Lindau disease was made. The family history was irrelevant. Complete physical examination was negative. Deep X-ray therapy was instituted, and resulted in disappearance of edema and attenuation of the lesion. Vision of 1/6 was maintained for two years without progress of the lesion. In 1927 tumors developed along the superior nasal vessels. This time deep X-ray therapy did not benefit. In 1929 other tumors were noted and the eye gradually became blind. In 1932 scleral staphylomas appeared in both eyes, coincidentally with attacks of hypertension. The man died in 1937 at the age of 31 years, with massive intestinal hemorrhages which, it was supposed, were due to telangiectases in the intestinal mucosa. The author suggests that this case supports the theory that angiomatosis

retinae and Coats's disease fall within Osler's syndrome of hereditary hemorrhagic angiomatosis.

J. Wesley McKinney.

Tice, G. M., and Curran, E. J. Treatment of retinoblastoma; radiation therapy supplementing surgical treatment. *Radiology*, 1944, v. 42, Jan., p. 20.

Retinoblastoma is second in frequency of the malignant neoplasms of the eye. The treatment, as in the case of any malignant tumor, aims to preserve life. The tendency to metastasize is not great. When the condition is bilateral, one is met with the alternative of (1) saving sight in one eye by destroying the tumor or (2) removing the other eye or removing both eyes. In some few cases either treatment is employed to make the last days of life more comfortable.

In unilateral cases a large percentage of cures is obtainable by enucleation with a long optic-nerve excision. Extension into the optic nerve or orbit cannot be foretold at the time of enucleation. Therefore one cannot be certain that metastasis does not exist.

The ophthalmoscope and the X ray, showing a characteristic picture when calcification has taken place, are the means of diagnosis.

Meningitis following intraorbital instrumentation may occur. From Martin and Reese's discussion of complications after X-ray therapy the following can be listed: corneal and conjunctival keratinization, glaucoma, cataract, and atrophy of the globe. Any of these could occur from the authors' method of radium therapy.

After presenting twenty cases with tabulated results, the authors advocate radiation therapy as supplemental to removal of the eye. Regardless of the

pathologic report, a logical procedure is to plant radium adjacent to the optic-nerve stump at the time of enucleation. Radiation therapy of the remaining eye has resulted in some visual preservation and a cure of the disease.

Because of the demonstrable sensitivity of retinoblastoma, an early tumor may be treated and cured by large doses of radiation alone.

Francis M. Crage.

## 16

### INJURIES

Casanovas, J. Radiography of localization with radiopaque substance at the limbus. *Arch. de la Soc. Oft. Hisp-Amer.*, 1943, v. 2, Jan.-Feb., pp. 120-124.

A silver ring 11 cm. in diameter and 0.5 mm. in thickness is fastened to the limbus by means of a fine two-pronged hook at each end of the horizontal diameter of the ring. Anteroposterior and lateral X rays are taken, localizing the foreign body in relation to the limbal ring. In order to obtain a measured localization, two circles are drawn one within the other, the smaller 11 mm. in diameter representing the ring on the limbus and the larger 24 mm. in diameter representing the circumference of the eyeball. The position of the foreign body is seen in the frontal X-ray plate as indicated on a diagram, where a circle 11 mm. in diameter represents the ring on the limbus and a circle 24 mm. in diameter represents the circumference of the eyeball. For the lateral view an 11-mm. vertical line is drawn, the ends of which coincide with the circumference of a 24-mm. circle. Taken together these two diagrams give an accurate localization of the foreign body. J. Wesley McKinney.

Chavira, R. A. Treatment of injuries of the anterior segment of the globe. *Anales de la Soc. Mexicana de Oft.*, etc., 1942, v. 17, Nov.-Dec., pp. 181-203.

The article describes in detail the treatment of penetrating wounds of the anterior part of the eye as practiced by the author. It is not adapted for abstracting and must be read in the original. Eugene M. Blake.

Cross, A. G., and Ball, J. Subconjunctival hemorrhage caused by aerobic flying. *Lancet*, 1943, v. 245, Dec. 18, p. 766.

The authors describe the case of an aircraft pilot whose plane executed an inverted spin; that is, the airplane fell, nose down, with the tail describing a circle, and the pilot on the outside of the circle. His vision was blurred, eyes felt "as if they were ready to pop." On landing, he had diplopia, pain on ocular movements, pain back of the left eye, and subconjunctival hemorrhage. After one week, vision was normal and diplopia had disappeared. The subconjunctival hemorrhage disappeared by the fifteenth day.

The symptoms were explained on the basis of orbital hemorrhage, due to the forcing of blood to the head by the centrifugal action of the falling plane. The opposite condition, "blacking out," may occur in a zoom when the blood is sucked away from the head.

Benjamin Milder.

Dansey-Browning, G. C. The value of ophthalmic treatment in the field. *Brit. Jour. Ophth.*, 1944, v. 28, Feb., pp. 87-98.

Five hundred and fourteen ophthalmic battle casualties, treated in a mobile ophthalmic unit during the Libyan campaign, are analyzed. An average of 36 hours elapsed between the time of

the initial wound and the preliminary examination. After application of a dressing at the regimental aid post, the only treatment received during this time was the oral administration of sulfonamides.

Although operative interference was confined to the absolute minimum, some 200 "major" operations had to be performed. There were 67 cases of intraocular foreign body. Because of prolapse of the iris, 21 of these were operated in the field. The sclera was sutured in 9 cases and simple conjunctival flaps were made for 7 other wounds. Five cases developed panophthalmitis and 13 showed a cyclitis at the end of the first month. Seventeen globes were enucleated.

Among the 22 cases of intraorbital foreign body with perforation of the globe were five cases with traumatic cataract. Two cases were subsequently reported to have retinal detachment and in one the vitreous was filled with hemorrhage. One case developed retinitis proliferans. Two eyes were enucleated. In 31 cases of nonpenetrating intraorbital foreign body the main damage was caused by concussion. There were four cases of optic atrophy. Five had lid injuries, and there were two cases of orbital cellulitis which resolved under oral sulfonamide therapy. There were 12 cases of hemorrhage into the vitreous.

Out of 192 cases of conjunctival, scleral and corneal foreign body, only one developed a hypopyon ulcer. One case with a scleral foreign body developed a pyocyanus abscess which resolved quickly and without ill effects.

There were 87 disorganized globes. No cases of sympathetic ophthalmitis have been reported from this series. Compared with Würdemann's figures of casualties in 1916, where out of 2,000

ophthalmic casualties only 698 eyes were retained, the total of 114 eyes lost in this series of 514 indicates that the modern policy of treatment in the field has not had adverse end-results. (2 figures, references.)

Edna M. Reynolds.

Gillette, D. F. A new aid in removal of foreign bodies of the cornea. *Arch. of Ophth.*, 1944, v. 31, Feb., pp. 129-133; also *Trans. Amer. Ophth. Soc.*, 1943, v. 41.

The author advocates the application of a silver-nitrate solution to foreign bodies of the cornea as an aid in their removal. After anesthetizing the eye with tetracaine, the foreign body is touched with a 1- or 3-percent solution of silver nitrate on a small cotton applicator. This produces a faint, gray swelling of the superficial epithelium, which elevates the foreign body slightly above the level of the surrounding cornea. It is then often possible to remove the foreign body with the end of a sharp toothpick. If the foreign body has been in the eye for some time a dull cystotome is recommended instead of a toothpick. The use of silver nitrate is not recommended in cases in which Bowman's membrane has been injured.

Experimental work on the rabbit cornea demonstrates that the intact epithelium undergoes little change after the use of silver nitrate. Application of silver nitrate to the abraded cornea produces superficial epithelial necrosis. Graphic representation of the location of foreign bodies on the cornea indicates that most of them occur in an area corresponding to the interpalpebral space when the patient is looking down. The earlier a corneal foreign body is removed the simpler is the removal and the shorter the period of

disability. (5 figures, 4 tables, bibliography.)

John C. Long.

Hurtault, J., and García Querol, A. Displacement of intraocular foreign body. *Arch. de Oft. de Buenos Aires*, 1942, v. 17, July, p. 417.

A magnetic foreign body lodged in the retina near the macula. In view of the technical difficulties involved, the authors displaced the foreign body to the equator of the eye with the magnet, whence it was extracted without complication. The possibility of changing the surgically unfavorable location of an intraocular foreign body in many cases is pointed out.

Plinio Montalván.

Kazdan, L. The use of a contact lens to improve vision in a seriously injured eye. *The Canadian Med. Assoc. Jour.*, 1944, v. 40, Feb., p. 157. (See Section 3, Physiologic optics, refraction, and color vision.)

Leoz Ortin, G. Ocular hemosiderosis, *Arch. de la Soc. Oft. Hisp.-Amer.*, 1943, v. 2, Jan.-Feb., pp. 45-51.

This is a discussion of blood staining of the cornea and other ocular tissues; associated with hemophthalmos resulting from contusion of the eyeball. The typical appearance of the cornea, the course of the condition, the differential diagnosis from dislocated lens, and the pathology are reviewed. If the cornea is observed with the slitlamp in the initial phases of infiltration, a contusive separation of the endothelium may be seen, together with folds and almost always radial tears in Descemet's membrane. It is probable that endothelial separation and tears in Descemet's membrane account for the blood staining seen in hyphemia resulting from contusions. The visual outcome in all

cases has been poor even though the cornea finally became entirely clear. This is attributed to the effects of blood staining of other ocular tissues as well as to the effects of the trauma itself.

J. Wesley McKinney.

Matthews, J. L. *Ophthalmic injuries of war*. War Medicine, 1943, v. 4, Sept., p. 247.

The author cites the fact that ophthalmic injuries composed 5 to 8 percent of the wounds in the first World War as evidence of the importance of a general appreciation of the problems connected with such injuries.

Traumatic injuries: Bomb blasts have caused intraocular and retrobulbar hemorrhage, choroidal rupture, and even destruction of an eye. The management of corneal and conjunctival foreign bodies in war casualties does not differ from that in industrial practice, but the intraocular foreign bodies present greater problems since many are nonmagnetic (aluminum-magnesium, plastic glass). Orbital fractures and lacerations of the orbital contents are caused by shell and bomb fragments and by flying débris. Among other conditions seen, the author mentions spastic entropion due to irritation of the infraorbital nerve, and enophthalmos due to orbital fractures. Military experience suggests the policy of anesthetizing an injured eye, flushing with boric acid, and applying a fairly firm dressing before evacuation of a casualty for specialized ophthalmic care. Other suggestions include the use of human hair in corneal lacerations, and careful removal of all bits of uveal tissue from the orbit in the case of a completely disorganized eye.

Thermal burns: Burns have caused a greater percentage of casualties in this war than in the last. In ocular

burns, the lids are the most frequently and most severely affected. First-aid treatment, in most cases, must be directed against shock, and the burned areas covered with vaseline gauze, or other nondisfiguring dressings. Conjunctival and corneal burns are treated with irrigation, flaps over burned areas of cornea, free use of lubricants, and prevention of symblepharon. Such burns have been treated with hydro-sulphosol, a strong reducing agent with antiseptic and epithelial stimulating properties. Important in treatment of the lids is removal of all oils or greases and careful washing. Many treatments are suggested for facial burns. Among them are gentian violet, with or without silver nitrate; sulfathiazole ointment (20 percent) in petrolatum-oxycholesterol.

Chemical burns are classified on the basis of the physiologic action of the offending agent: (1) Lung irritants (phosgene, chlorine) produce varying degrees of conjunctival irritation. (2) Vesicants (mustard gas, lewisite) produce irritation of lids and conjunctiva in milder cases, marked chemosis and superficial punctate keratitis. Characteristically there is delay of two to six hours from time of exposure to the onset of the symptoms; there is intense blepharospasm. In severe cases, there is corneal vascularization during healing, and there may be recurrences after many years. (3) Lacrimators (tear gas) produce transient ocular irritation, as do (4) irritant smokes (Adamsite). (5) Screening smokes cause no ocular damage, but contact with white phosphorus or (6) incendiary agents will cause circumscribed burns. Treatment is discussed. Benjamin Milder.

Minsky, Henry. Transcleral removal of intraocular foreign bodies with the

aid of the Berman locator. *Arch. of Ophth.*, 1944, v. 31, March, pp. 207-210.

When the anterior approach for the removal of an intraocular steel splinter proved unsuccessful after three attempts, it occurred to the author that the posterior route might be rendered less hazardous by use of the instrument which was so effective at Pearl Harbor in the hands of Moorehead. The idea of utilizing magnetism to locate steel in the body has been proposed many times. The development of Berman's locator has made its use more practical.

The locator contains a diagnostic rod having the equivalent of two transformers—one in the handle and the other at the tip. In series the primary coils are connected to the alternating current, and the secondary coils through an amplifying unit to a voltmeter. An alternating current sent through the primary coils induces a secondary current. When the coil in the tip of the rod approaches magnetic metal a difference in potential takes place in the secondary circuit. The amount of the current, shown by deflection of the needle in the voltmeter, varies with the size and distance of the metallic particle. At the greatest point of deflection the tip of the locator is immediately over the foreign body.

The handling of an illustrative case is described in detail. The operative technique consists of a scleral flap in the region of greatest deflection by the locator, which has been marked with a silk intrascleral suture. A barrage of seven microcautery punctures is made around the flap with the Kronfeld needle. The needle is also used to cauterize lightly the exposed sclera and underlying retina in order to prevent subsequent retinal detachment. The

foreign body is then allowed to cut its way through the choroid and retina under the pull of the magnet. The author agrees with Spaeth in deprecating the introduction of magnet points or magnetized instruments into the vitreous.

If roentgenographic localization is impossible or not immediately available, much time is saved by using the locator at once. In cases in which the differential diagnosis between a foreign body inside the eye and one just outside the sclera is difficult, the problem may easily be resolved by the locator once Tenon's capsule is opened. (9 diagrams, references, discussion.)

R. W. Danielson.

Neblett, H. C. Bilateral cataract from electrical shock? *Southern Med. and Surg.*, 1944, v. 106, Jan., p. 12.

This paper reports the case of a thirty-year-old male whose forehead came into contact with a wire carrying 11,000 volts. The author, seeing the patient three months after the accident because of decreasing vision in the right eye, noted fine dust-like opacities on the anterior surface of each lens. There were no other pathologic findings. Corrected vision was: right eye 20/30; left eye 20/20. Within ten months, both lenses were opaque, presenting a "hammered silver" appearance, with a stellate gray opacity lying on the anterior capsule of each lens. In each eye a combined intracapsular lens extraction was performed, with the stellate opacity remaining in the anterior chamber of the right eye. Final corrected vision was 20/20 and Jaeger 1 in each eye.

The author believes that, although no definite etiology can be assigned to a cataract of suspected traumatic origin without having information regarding

the status of the eyes immediately prior to the accident, nevertheless the early appearance of the lens opacities and the history make it quite likely that the case reported represents electrical-shock cataract. Opposed to this diagnosis are the facts that electrical cataracts are usually not progressive, and that they are frequently accompanied by foveal degeneration and optic atrophy.

Benjamin Milder.

Schorstein, Joseph. Gunshot wounds of the fronto-orbital region. *Lancet*, 1944, v. 246, Jan. 8, p. 44.

This paper reports ten cases of gunshot wounds involving orbit and frontal lobe of the brain, eight of which were operated upon by the author. Three of the patients were treated by removal of the destroyed brain tissue and bone fragments, followed by primary closure of the dural tears with fascia lata grafts, sewed in place. Two of the three recovered, the one death being due to pulmonary collapse. Four cases were treated by sprinkling the brain cavity with sulfanilamide powder and packing with soft paraffin-gauze packs. There were no fatalities. One case was treated with dural closure and extradural packs. There is no detailed description of the handling of the orbital tissues, or the involved eye, beyond the débridement of the area.

Benjamin Milder.

Smith, H. E. Actinic macular retinal pigment degeneration. *U. S. Naval Med. Bull.*, 1944, v. 42, March, p. 675.

On a South Pacific tropical island, 150 patients, with identical complaints and a characteristic ophthalmological picture, were examined. Each patient noted, after 4 to 8 months in the tropics, some blurring of vision, near and distance; and, in some instances, as-

thenopic symptoms. These patients showed corrected vision of from 20/20 minus to 20/30 (although they had been listed as 20/20 on their health records), and the acuity was lessened by using a pinhole disc. The macula in each case showed either (1) most frequently, sharply defined granular pigment distribution, or (2) increased pigmented tissue arranged radially; or (3) least often, a proliferated mottled pigment disturbance. The area involved was one half disc diameter, there was slight macular edema, and the foveal reflex had a dispersed, honeycombed appearance.

In each case, the patient had been doing outdoor work and had not worn colored glasses (most patients wore no glasses). The condition was not noted among "indoor" workers.

Benjamin Milder.

Trexler, C. W. War-induced eye injuries. *U. S. Naval Med. Bull.*, 1944, v. 42, Jan., p. 124.

For the benefit of the Navy physician not specially trained in ophthalmology, the author gives a comprehensive outline of the commoner types of eye injury and their emergency treatment.

R. Grunfeld.

Wakeley, Cecil, and others. Discussion on burns of the eyelids and conjunctiva. *Proc. Royal Soc. Med.*, 1943, v. 37, Nov., p. 29.

The experiences of several surgeons with various types of war burn are reported and discussed. Findings of particular interest are: the abolition of picric-acid treatment, the lack of success of tannic-acid treatment, use of a cellulose-acetate mask which reduced the incidence of burns, saline dressings, some deaths which may have been caused by poorly supervised use of sul-



fonamides, and successful use of penicillin. Prevention of infection, prevention of fluid loss to lessen shock, contact lenses to prevent symblepharon, the use of only mild coagulants, and early skin grafting are strongly emphasized.

Francis M. Crage.

# 17

## SYSTEMIC DISEASES AND PARASITES

Bugnone, Enrique. Vitamin A, hemeralopia, and the biophthalmometer. *Anales Argentinos de Oft.*, 1944, v. 4, Jan.-Feb.-March, pp. 6-17. (See Section 1, General methods of diagnosis.)

Dienst, E. C., and Gartner, S. Pathologic changes in the eye associated with subacute bacterial endocarditis. *Arch. of Ophth.*, 1944, v. 31, March, pp. 198-206. (See Section 10, Retina and vitreous.)

Izzet Bilger. Significance of vitamins in ophthalmology. *Göz Klinigi*, 1943, v. 1, Sept., p. 43.

A survey of the literature.

Kutscher, M. Changes in optic function and ophthalmoscopic picture in four patients of the eunuchoid skeletal type who were treated with orchic extract. *Arch. Internal Med.*, 1943, v. 72, Oct., pp. 461-470.

Four patients of the above type were found to have decreased visual acuity, diminished amplitude of accommodation, contraction of the visual fields with some color defect, and changes in the eye grounds ranging from hyperemia and postneuritic signs to complete decoloration of the nerve heads. After treatment with injections of an orchic extract, all of the above findings showed marked improvement as well as a subjective improvement with a

feeling of well-being and loss of fatigue.

T. E. Sanders.

Pino, R. H., and Hultin, G. L. Treatment of asthenopia nonpathologic and nonrefractive in origin. *Amer. Jour. Ophth.*, 1944, v. 27, May, pp. 520-523.

Poyales, Ureña. Contribution to the study of central scotoma due to avitaminosis, or contribution to the study of carential (vitamin deficiency) central scotoma. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1942, v. 1, Nov.-Dec., pp. 561-567. (See Section 12, Visual tracts and centers.)

Reese, A. B. Congenital cataract and other anomalies following German measles in the mother. *Amer. Jour. Ophth.*, 1944, v. 27, May, pp. 483-487. (References.)

Soria Escudera, M. Conjunctival euliasis. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1943, v. 2, Jan.-Feb., pp. 72-76.

The author prefers this term to the commonly used "myiasis." Two cases are reported in which the larvae were deposited by a fly which was noticed to pass close to the eye. Severe pain occurred immediately and the eye rapidly became red. Under cocaine the larvae were removed: they were found to be *Oestrus ovis*.

J. Wesley McKinney.

# 18

## HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Bahn, C. A. Ophthalmic requirements of the military services. *Arch. of Ophth.*, 1944, v. 31, Feb., pp. 160-161.

This is a statement of changes made in ophthalmic requirements for the various branches of military services from February 1, 1943, to January 1,

1944. The requirements are not listed in full, only the sections involving change being quoted.

John C. Long.

Burke, F. S. *The blind in Canada*. Canadian Jour. Public Health, 1943, v. 34, Aug., p. 347.

The article treats of the causes of blindness, the number of blind people, and their employability, with the addition of various statistical tables. Blind pension is discussed.

Francis M. Crage.

Glover, L. P., and Brewer, W. R. *An ophthalmologic review of more than twenty thousand men at the Altoona Induction Center*. Amer. Jour. Ophth., 1944, v. 27, April, pp. 346-348. (One table.)

Hayes, S. P. *New methods of testing the school achievement of blind pupils*. Outlook for the Blind, 1943, v. 37, Dec., p. 277.

Due to slowness of Braille reading, the standard achievement tests are not fully adaptable to testing the blind pupil without some modification. Several changes and omissions are necessary to provide for the special needs of the blind. Such is, for instance, the modified oral test. The tester reads the question and the pupils read the alternative answers in Braille, then the questions are read aloud a second time and the pupil marks with a pencil the answer he prefers. The matching test, which requires a rapid glancing to and fro, is replaced by the multiple-choice test. The pupil has before him a set of five dots for each question. The tester reads the questions and the alternative answers several times aloud, and the pupil is then supposed to draw a line

through the dot in the row which corresponds to the best answer. For example, if the best answer is the fifth word, the pupil draws a line through the fifth dot.

R. Grunfeld.

Irwin, R. B. *Why rehabilitation of the blind is a function of a special agency for the blind*. Outlook for the Blind, 1943, v. 37, Dec., p. 275.

The author sets forth the reasons why it is necessary for the vocational rehabilitation of the blind to be carried out by special agencies, as provided by the Barden-La Follette bill recently enacted into federal law.

The various state agencies, the Department of Welfare, the Department of Education, and so on, have neither the special knowledge, available time, nor the equipment necessary for vocational rehabilitation of the blind, nor can they provide the special social care needed by the blind to give them continuous supervision and to maintain employment opportunities. The formation of a special agency, furthermore, avoids the creation of duplicate agencies for rehabilitation of those who are not eligible for employment, particularly the young, who may constitute 75 percent of the blind population. Since the law provides only for those who have no other means of rehabilitation, the financial resources of the blind must be investigated. The special agency is best equipped to make such investigations.

R. Grunfeld.

Kerby, C. E. *Eye conditions among pupils in schools for the blind in the United States, 1941-1942*. Outlook for the Blind, 1943, v. 37, Nov., p. 245.

The article is the ninth published summary of the Committee on Statistics for the Blind in the United States. The schools and their enrollment are

listed. The various tables include a rather extensive one showing the causes of blindness. This report refers to the year 1941-1942, with no new causes added, but a suggestion follows showing need for more detailed information in those cases of blindness from general diseases which are reported simply as "prenatal origin, cause not specified." Francis M. Crage.

Kronfeld, P. C. Preventable blindness. *Jour. Michigan State Med. Soc.*, 1944, v. 43, March, pp. 209-214.

Approximately 0.1 percent of the population is blind in one or both eyes, there being approximately 130,000 blind persons in this country. In a survey covering an unmentioned number of persons, the percentages of the major causes of blindness were: uveitis 24 percent, glaucoma 16 percent, trauma 15.4 percent, optic atrophy 15 percent, retinopathies 11 percent, and congenital anomalies and hereditary diseases 10.4 percent. Industrial accidents are responsible for bilateral blindness of 8,000 and monocular blindness of 80,000 persons. The author emphasizes the importance of the early recognition of glaucomas and their continued care. Unfortunately, early glaucomas are often not recognized, being concealed behind cataracts and other more easily diagnosed conditions. Early treatment with sulfonamide therapy following perforating injuries of the eye is advised, although the results obtained are not strikingly better than in the presulfonamide era. The only positive protection against interstitial keratitis is efficient prenatal anti-luetic therapy before the fifth month, and only very energetic treatment with arsenicals in early syphilis reduces the danger of neurosyphilis and optic atrophy. Charles A. Bahn.

Lavos, George. Industrial homework for the physically handicapped. *Outlook for the Blind*, 1943, v. 37, Oct., pp. 214-218; and Nov., pp. 253-259.

The NRA made the first nationwide attempt to control or virtually to prohibit industrial homework, although some exemptions were granted in the case of the physically handicapped. The control of such homework varies in different states. Obviously for health reasons, some states prohibit the home manufacture of food articles, drinks, food containers, explosives, toys and dolls, and drugs and poisons. In other instances, because of conflict with the nonhandicapped, labor standards deny the blind industrial homework.

The author feels that because of the social and economic dangers involved in homework, its eventual abolition is desirable. Agencies for the handicapped should take steps to abolish the need for exemptions, by adequate programs for the substandard handicapped. (4 tables, references.)

Francis M. Crage.

Lowenfeld, Berthold. Dramatic arts for blind children. *Outlook for the Blind*, 1943, v. 37, Sept., p. 187.

The use of the dramatic arts in the training of blind children is of extreme value since it brings to the student an opportunity for creative interpretation of a variety of characters and enables him to extend his experiences, while giving him the satisfaction and self-confidence of achievement. Creative activities such as drawing and painting are impossible. Modeling and music, although valuable, have technical aspects which make them not so generally applicable.

Since 1940 a teacher-training course has been given, first under the sponsorship of the president of the Ameri-

can Foundation for the Blind, and later under a grant from the Rockefeller Foundation. This has led to establishment of a Dramatic-Arts Project, which has given assistance to this program in many of the resident schools for the blind throughout the country. Progress in personality adjustment and in training of the blind child by this means has so far been very gratifying.

Owen C. Dickson.

Nicholls, J. V. V. *Ophthalmology in the R.C.A.F. Canadian Med. Assoc. Jour.*, 1944, v. 40, April, pp. 335-338. (See Section 1, General methods of diagnosis.)

Paula Santos, B. *Refractive errors in schoolchildren of São Paulo. Arquivos Brasileiros de Oft.*, 1943, v. 6, Oct., pp. 151-157.

A statistical report, along familiar lines. The author appears to be associated with the School Health Service of São Paulo.

W. H. Crisp.

*Rehabilitation of the blind in Army hospitals. Outlook for the Blind*, 1943, v. 37, Sept., p. 191.

This is a statement of the rehabilitation program as issued from the office of the Surgeon General of the United States Army. The policy consists briefly of establishing, at the earliest possible moment, contact between the blinded casualty and trained personnel including psychiatrist, psychologist, and social worker. Experience arising from the St. Dunstan's movement in England during the last war demonstrated the value of early association of the newly blind and a blind individual who has made an adjustment to his own handicap. This is important before the psychological aspects of

deprivation of sight have made deep inroads on the personality.

This program is not to supplant the work of the Veterans Administration Facility but to initiate such action while the patient may still require convalescent care in one of the Army hospitals. Facilities are at present available at the Valley Forge General Hospital in Phoenixville, Pennsylvania, and at Letterman General Hospital in San Francisco, California. Early transfer of blinded cases to these centers is the present aim. The complete program includes instruction in special techniques, development of a philosophic outlook, vocational advice, psychological and psychiatric study, and arrangements with other agencies for further care.

Owen C. Dickson.

Shoemaker, R. E. *Emergency-room service at Wills Hospital. Arch. of Ophth.*, 1944, v. 31, March, pp. 211-213.

The author presents a résumé of the number of patients, the types of cases encountered, and the methods used in handling the large number of patients in the emergency room at Wills Hospital, Philadelphia.

R. W. Danielson.

Smith, V. M. *The problem of prevention of blindness among glaucoma patients. Med. Woman's Jour.*, 1943, v. 50, Dec., p. 301.

The National Society for the Prevention of Blindness has organized a special campaign for the control of glaucoma. Its objectives are to educate the general public concerning the early signs and symptoms of glaucoma, to offer informative material to professional groups, and to establish special glaucoma clinics in order to secure an early diagnosis and adequate treat-

ment. Since most of the special clinics earlier established have been abandoned due to reduction of staff, the Society has started a demonstration clinic in one of the leading hospitals of New York City. It is intended to prove the value of keeping glaucoma patients under close supervision in order to study the effectiveness of treatment. It aims also to gather research data by the use of special record forms and to provide professional groups with a center for observation and training; and to train volunteers in the charting of visual fields and other details of diagnosis and general care.

R. Grunfeld.

Stinchfield-Hawk, Sara. *Motokinesthetic speech training applied to visually handicapped children*. Outlook for the Blind, 1944, v. 38, Jan., p. 4.

Up to this time provision for the problems arising in connection with the education of the preschool blind child has not been made. It has been shown by speech surveys that there exists a larger percentage of speech defects among the blind than in an unselected group of seeing children of the same age. Educational prognosis in the blind becomes less favorable with speech defects. Motokinesthetic training, enabling the children to control their speech muscles, is an important step in the education of these doubly handicapped individuals; but too little is being done.

F. M. Crage.

## 19

### ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Gruenwald, Peter. *Studies on developmental pathology*. 1. The morphogenesis of a hereditary type of microphthalmia in chick embryos. Anat. Record, 1944, v. 88, pp. 151-178.

The author describes the morphogenesis of a hereditary type of microphthalmia in chick embryos which is transmitted by a single autosomal recessive gene. A regular succession of stages was found leading to uniform conditions in all embryos of comparable age. The initial stage is formation of minute cysts in the retina. The cells lining these cavities divide mitotically and thus form abnormal centers of growth. Some retinal folds appear, with similar abnormal folds in the ectodermal layers of the iris and ciliary body. These folds later undergo degeneration. The pecten is absent and the scleral cartilage is relatively normal. The lens is only slightly reduced in size, but the eyeball itself is finally reduced to about one half its size. The chicks hatch but soon die, being blind. The significance of these changes is discussed.

T. E. Sanders.

Marinis, F. *Bar-eyed mosaics in drosophila*. Jour. of Heredity, 1943, v. 34, Aug., p. 227.

This is a short technical article on the genetic changes in the eyes of the fruit fly.

Francis M. Crage.

# NEWS ITEMS

Edited by DR. DONALD J. LYLE

904 Carew Tower, Cincinnati 2

News items should reach the editor by the twelfth of the month.

## DEATHS

Dr. Calvin Bates, Cambridge, Ohio, died March 28, 1944, aged 87 years.

Dr. Henry B. Beeson, Racine, Wisconsin, died March 4, 1944, aged 62 years.

Dr. Will O. Bell, Seattle, Washington, died February 3, 1944, aged 67 years.

Dr. M. Robert Byrnes, Indianola, Nebraska, died March 3, 1944, aged 73 years.

Dr. Eliphalet A. Cornell, Sault Sainte Marie, Michigan, died February 19, 1944, aged 81 years.

Dr. John E. Crawford, Bartlesville, Oklahoma, died March 19, 1944, aged 73 years.

Dr. William Thornwall Davis, Washington, D.C., died June 16, 1944, aged 67 years.

Dr. Rudolph T. Ehrhardt, Saint Louis, Missouri, died March 24, 1944, aged 79 years.

Dr. H. A. Gerbig, Independence, Kansas, died February 28, 1944, aged 66 years.

Dr. Paul C. Graham, Columbus, Indiana, died February 25, 1944, aged 64 years.

Dr. Frederick W. Jones, Girard, Kansas, died February 21, 1944, aged 72 years.

Dr. Henry H. McCrea, Matamoras, Pennsylvania, died March 10, 1944, aged 67 years.

Dr. Ambrose V. McRee, Mayfield, Kentucky, died February 28, 1944, aged 82 years.

Dr. Millen A. Nickle, Clearwater, Florida, died March 6, 1944, aged 63 years.

Dr. James E. O'Toole, Scranton, Pennsylvania, died February 21, 1944, aged 60 years.

Dr. Benjamin N. Searcy, Rising Sun, Indiana, died March 6, 1944, aged 66 years.

Dr. Don Rafael Silva, Mexico, D.F., died April 19, 1944.

Dr. William I. Simpson, Los Angeles, California, died February 22, 1944, aged 70 years.

Dr. Adam Weaver, Cumberland, Iowa, died February 26, 1944, aged 77 years.

## MISCELLANEOUS

The next examination by the American Orthoptic Council will be held in September-October, 1944. The written examinations will be held at various cities in the country on September 7, 1944. Only those passing the written examinations will be permitted to take the oral and practical tests, to be given in Chicago, October 7, 1944. Applications on official forms

must be received before August 1, 1944. Address the American Orthoptic Council, 23 East 79th Street, New York 21, New York.

The Board of Regents of the American College of Surgeons has decided to hold the thirty-second annual clinical congress of the American College of Surgeons in the form of a War Session, October 24-27, 1944, in Chicago, Illinois.

The ninth annual assembly of the International College of Surgeons will be held October 3-5, 1944, in Philadelphia. The program will be devoted to War, Rehabilitation, and Civilian surgery.

## SOCIETIES

The New York Society for Clinical Ophthalmology elected the following officers for 1944-1945: Dr. Milton Berliner, president; Lieutenant Commander Benjamin Friedman, vice-president; Dr. Leon Ehrlich, recording secretary; Dr. Benjamin Esterman, corresponding secretary; and Dr. Daniel Kravitz, treasurer.

Dr. Isadore Givner was a guest speaker at the annual meeting of the Pennsylvania Academy of Ophthalmology and Otolaryngology held at Wilkes-Barre, Pennsylvania, on May 10th. The subject of his address was "The importance of etiological diagnosis in ocular infections."

The Research Study Club of Los Angeles will hold its fourteenth annual mid-winter postgraduate clinical convention in ophthalmology and otolaryngology from January 22 to February 2, 1945. Following this session there will be a special course in "Applied anatomy and cadaver surgery of the head and neck" from February 2-6, inclusive.

## PERSONALS

Major Carl J. Rudolph (MC) requests that oculists who have found uveitis or any other eye involvements that may be attributed to rheumatic fever notify him of such findings; with a short résumé of the case history, at Regional Station Hospital, Buckley Field, Colorado.

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## A TYPE OF FOVEO-MACULAR RETINITIS OBSERVED IN THE U. S. NAVY

FREDERICK C. CORDES, M.D.  
*San Francisco*

This report is an attempt to correlate and evaluate the available data from a type of central retinitis observed in the United States Navy personnel and occurring primarily in the Pacific Area. The study was made at the request of the National Research Council, Sub-Committee of Ophthalmology, with the consent of Ross T. McIntire, Surgeon General of the United States Navy, and the coöperation of Capt. W. W. Hall (MC), U.S.N., of the Research Division, Bureau of Medicine and Surgery.

The data were furnished by the following Navy Medical Officers with the consent of their executive officers:

Capt. Warren D. Horner (MC),  
U.S.N.R., U.S. Naval Hospital,  
Navy #10, Hawaiian Islands.

Commander J. W. Thompson (MC),  
U.S.N., U.S. Naval Hospital, Mare  
Island.

Commander Hugo Lucic (MC),  
U.S.N.R., U.S. Naval Hospital, San  
Diego, California.

Lt. Commander David O. Harrington  
(MC), U.S.N.R., U.S. Naval Hos-  
pital, Seattle, Washington.

Lt. Commander W. E. Borley (MC),  
U.S.N.R., U.S. Naval Hospital,  
Oakland, California.

Lt. Commander A. W. McAlester,  
(MC), U.S.N.R., U.S. Naval Hos-  
pital, Oakland, California.

Lt. Commander Charles Ray Lees  
(MC), U.S.N., U.S. Naval Hospital,  
Pleasanton, California.

Lt. Commander C. E. Flack (MC),  
U.S.N., U.S. Naval Hospital, Pleas-  
anton, California.

Lt. Commander Bruce Stevens (MC),  
U.S.N.R., U.S. Naval Hospital,  
Mare Island, California.

Lt. Commander W. P. McGuire (MC),  
U.S.N.R., A hospital ship.

Lt. Michael J. Hogan (MC),  
U.S.N.R., U.S. Naval Hospital,  
Treasure Island, California.

I have had the opportunity of examin-  
ing some of the cases at the Naval Hos-  
pitals at Mare Island, Oakland, and  
Treasure Island. Lees, Hogan, Borley,  
and Stevens made it possible for Dr.  
Aiken to photograph the lesions at the  
University of California.

On November 10, 1943, it was possible  
to arrange an evening meeting with Lucic,  
Borley, McAlester, Lees, Flack, Stevens,  
Hogan, and Aiken. At that time the report  
was read, discussed, and altered to its  
present form.

In May of 1941, Lees, while stationed  
at Pearl Harbor, was impressed by the  
number of monocular macular lesions  
seen in the Navy personnel. The percent-  
age seemed all out of proportion to those  
seen in civilian practice in a similar age  
group. Later similar observations were



made at Naval Hospitals along the Pacific Coast as men began to return from the Pacific Combat Area. In the spring of 1943, Flack called the condition to the attention of Dr. Harry Gradle, chairman of the Sub-Committee of Ophthalmology of the National Research Council. It was due to his efforts that this study was made. The following must be considered as a preliminary report based on the data at present available. Various types of macular lesions have been observed. These fall into the following general classification:

- (1) Extensive central retinal changes due to contusion
- (2) Nontraumatic macular chorioretinitis
- (3) Hole in the macula
  - (a) traumatic in origin
  - (b) solar burns
- (4) An unusual type of foveo-macular disease that suggests a cyst or hole in the fovea and that is on a non-traumatic basis

The first three deserve brief comment so that the fourth type may be better understood.

*Macular changes due to trauma.* In this group are those cases of rupture of the choroid and retina in which extensive damage is done to the macular area. It is the typical large irregular lesion in and around the macular area that follows contusion. The severest cases are those in which there has been orbital injury. These cases have been seen at all the stations and are identical with the contusion injuries reported in the last war.

*Nontraumatic macular chorioretinitis.* This condition, identical with the various types of lesions seen in civil practice, has been observed a number of times by various observers and does not warrant detailed consideration here.

*Hole in the macula.* This lesion warrants consideration because it must be ex-

cluded from the condition under consideration here.

(a) *Traumatic hole in the macula.* Commotio retinae, or Berlin's edema, often develops immediately after trauma, reaches its height in 24 to 36 hours, and gradually subsides in a period of 3 to 4 days. It occasionally requires as long as eight days to subside and may disappear without leaving any traces. In some instances, however, this is followed by the development of a hole in the macula. The hole appears to be punched out, with perfectly round sharp edges and, what is very striking, reveals in the depths an area of choroiditis with atrophy and pigment proliferation corresponding to the retinal lesion. Stevens saw three such cases of Berlin's edema followed by a hole in the macula; two were noncombat injuries whereas the third was a war injury. Harrington observed one patient with the typical lesion who, in one of the battles of the Aleutians, was blown across the deck by a near miss. Borley and other observers have noted similar cases.

(b) *Hole in the macula due to solar burns.* Cases of typical "eclipse" burns have been noted by most of the aforementioned observers. It is usually associated with the use of the "long glass," a monocular telescope of about 20 times magnification. Two typical histories illustrate this type. Horner reported one instance of a signalman on destroyer duty in the Southwest Pacific who was following an enemy plane with the "long glass" and "followed it into the sun." He noted immediate pain before the eye with resultant loss of vision and the formation of the typical punched-out hole in the macula. Stevens's patient was watching an enemy plane during a battle in the Pacific and followed the plane "through the sun" with the resultant loss of central vision and the production of a hole in the macula. Stevens had another patient who, fol-

lowing a burn in the right eye, switched the glass to the left eye, with a similar effect to that eye. He now has a bilateral typical hole in the macula. Both Horner and Stevens noted that there is no pigment change in the area surrounding the lesion in these cases that are the direct result of solar burns.

#### FOVEO-MACULAR RETINITIS

The type of central retinitis under discussion here did not fit into any of the aforementioned groups.

*Number of cases.* It is difficult to estimate the number of cases that have been observed, as men are transferred from one hospital or station to another and are often studied by several observers. Lees, however, states that between May, 1941, and July, 1943, during which time he was stationed at Pearl Harbor and Treasure Island, he saw between 250 to 300 cases. As well as can be determined, approximately 176 cases have been studied in detail in various hospitals as the basis of this report.

*Lesion.* The pathologic changes are limited to the fovea and the surrounding area. In the early stages there is edema with absence of foveal reflex, which Lees describes as a preretinal wheal. Harrington notes that the fovea has a "smudged-over" appearance. Borley describes the early stage as a small round gray infiltrate at the fovea, that when observed with the binocular ophthalmoscope has a punched-out appearance. Lucic states that at first there is a disturbance of the pigment characterized by a fine granular stippling in the macula. Lees, Lucic, and Hogan emphasize that in the early stages it is difficult to differentiate between these changes and a normal macula. Surrounding the fovea is a "bright circle" of almost 1 disc diameter (Harrington) which becomes a red ring at the end of the fifth or the seventh day (Borley). In a few

weeks the area develops a fine dustlike pigment mottling that has been described by most observers as a gray area. Lucic describes the later stage as a minute, vertical, oblique, or horizontal cherry-red line or spot appearing in the fovea, which can be seen only with the aid of special illumination (giant ophthalmoscope). In about 50 percent of the cases (Harrington) a minute hole in the macula appears, involving primarily the fovea, which has the appearance as though due to complete absence of the retina in this area (Borley). Borley and McAlester have emphasized that the lesion is primarily a foveal one. This has been observed by others (Lees, Horner, Stevens, Flack, Lucic, Hogan). Lucic says that the final picture is that of an irregular pink or grayish-pink holelike lesion in the fovea surrounded by an area of heaped-up pigment. This heaping-up of pigment makes the central area appear depressed so that it looks like a hole. In Lucic's opinion the lesion was definitely not a hole. Later in some cases small cystic degenerative lesions appear that give the area a honey-combed appearance, and they may coalesce to form a rather typical hole in the macula (Lees, Borley). Over a period of several months the lesion may become somewhat larger or remain stationary (Lucic). A small hemorrhage was observed in one instance and at times a small cyst may appear surrounded by hemorrhage (Borley). Lees observed that the vessels seemed 15 years older than the age of the patient and that drusen occurred more frequently than one would expect in this age group. Harrington and Borley both had the impression that the vessels were not abnormal.

The typical well-developed lesion, according to personal observation and the available data, seems to be that of a hole or cyst in the fovea surrounded by a gray area, 0.5 to 1 disc diameter in size, the

gray area being due to the presence of fine granular pigment. It is possible that in some instances the piling-up of pigment around the fovea may account for the similitude of a hole. In some cases small multicystic areas of degeneration may appear that give the fovea a honeycombed

further loss of vision accompanied by the gradual development of a hole in the macula.

*Symptoms.* Three investigators (Borley, Harrington, Lucic) have noted that the patients in many of the typical cases had a rather unusual type of headache.

Borley noted that they described a pain in the back of the eye usually associated with a "boring" type of headache on the side of the lesion. In some cases this headache persisted three to four months. Pain and headache were increased in bright light or heat. In one of Harrington's cases headache and photophobia reappeared when the patient returned to his work, where he was exposed to the heat and glare of boilers. Harrington also found the headache to be behind the eye, with occasional cases in which the pain was in the eye itself. In all the cases observed by him the headache was bilateral,



Fig. 1 (Cordes). Small, irregular, holelike or cystlike lesion in the fovea (R.E.).

aspect, and that finally a typical hole in the macula, surrounded by the aforementioned gray area, may develop.

The remainder of the eye, as studied under the slitlamp, is normal. Pupillary reactions also are normal (Borley, McAlester).

Many cases probably occur without disturbance of visual acuity and go unrecognized, leaving no evidence of the disease (Hogan).

*Recurrence* has been observed in only one case (Harrington). In this patient the condition cleared with a resultant vision of 20/25. Six months later the patient returned with the typical headache and

and frontal or orbital. It was the low frontal or orbital character that he thought typical. Lucic found that 10 percent of his patients complained of a frontal or fronto-temporal headache and that occasionally some complained of dizziness. The retrobulbar pain, however, was present in all of his cases. Photophobia was stressed by Harrington, Borley, McAlester, and Flack. Most of the patients personally interviewed gave the aforementioned symptoms; there were, however, a few who appeared to have the typical lesion in every way but did not have symptoms of headache. The following description given by a chief machinist's

mate, who had seen duty in the South Atlantic and Caribbean, is typical. The headache, which had developed simultaneously with his loss of vision, was of four months' duration. The pain was frontal or parietal with at times some low occipital involvement and was associated with some pain or aching in the eyeball itself. He stated that the headache was different from any he had ever had and that it was a "sort of dead and warm feeling."

Hogan elicited the headache and pain symptoms behind the eye infrequently in connection with the lesions, and concluded that headache, retrobulbar pain, and the sensation of foreign body were not important and probably not significant.

*Vision.* Vision during the acute stage varies a great deal depending upon the degree of involvement and has been reported as varying from 5/200 to 20/20 (Borley, Harrington, Flack, Lucic, Horner, Stevens). According to Lees, the average acuity was between 20/25 and 20/30. In some cases the vision returned to 20/20, whereas in others the final vision was as low as 5/200 (eccentric fixation). Borley noted that at times the initial improvement was later followed by further loss. In the patients personally observed, the final vision varied between 10/200 and 20/20+.

*Binocular involvement.* All the cases seen by Stevens were monocular, whereas Lees, Borley, McAlester, and Harrington reported 25 percent to be binocular. Lucic found 61 percent of his cases to be bilateral. In the 10 unilateral cases the

right eye was affected in six and the left eye in four of the patients. In these cases, in most instances, the second eye became involved after the first had healed. In one of Horner's cases the second eye became involved while the patient was in the hospital under observation. The degree of



Fig. 2 (Cordes). Foveal lesion similar to that shown in figure 1, and typical as to the size most commonly seen (L.E.).

involvement of the second eye varied a great deal.

*Perimetric and Screen fields.* Perimetric field studies show the changes to be limited to the central area. On the screen the average central scotoma is between 0.5 to 3 degrees (Harrington, Stevens, Borley, Lucic, Lees, Horner). The size of the scotoma does not vary with the size of the test object and is sharply limited. McAlester noted that the scotoma was larger than the foveal area and covered the area of the pigmentary change. This agrees with our findings in some of the cases observed. Harrington noted that in the early stages the scotoma was on the

average 0.5 degree in size. It is also interesting to note that in those cases wherein the vision returned to 20/20 it was impossible to demonstrate a scotoma with 1-mm. test object at 2 meters, even though the "hole" in the fovea remained (Harrington, Hogan). At times the central scotomata were as large as 8 to 10 degrees, with the vision reduced to light perception (Borley).

*Age.* The average age of the patient in Borley's and McAlester's series was 23 years, whereas in Harrington's patients it was 25 years. The patients in Lucie's group were between 17 and 30 years, with an average age of 21 years.

*Occupation.* There seems to be no relation between the disease and occupation, for the condition has been observed in men having a variety of occupations; for example in machinists, seamen, signalmen, coxswains, fire-control men, pharmacist's mates, marines, and others. Hogan failed to see the condition in an officer and believed that loss of sleep, fatigue, and subnormal working conditions might be a factor in explaining this discrepancy.

*General physical examination.* The findings reported are based on the data obtained from approximately 176 cases studied in the various Naval Hospitals. The largest single series is that of Lees who studied 50 cases at Pearl Harbor before the "blitz." All observers agree that no common physical findings were noted in these cases.

All observers found a small percentage of cases with evidence of focal infection such as abscessed teeth, infected tonsils, and sinus disease, but all concluded these findings were merely coincidental.

Genito-urinary examinations also were of no significance. The incidence of gonorrhea was no higher than one would expect. A positive history was obtained in about 11 percent of the cases (Lees, Borley, Harrington). The incidence of lues,

based on a positive Wassermann test, was less than 1 percent in most series (Lees, Borley, McAlester, Harrington, Stevens, Horner).

Intradermal tuberculin tests also were insignificant. Lees found the test positive in less than 5 percent of his cases, and Borley in 0.9 percent. Horner found only one positive case and Harrington found none in his series of 16 patients.

Lees performed a histamine-sensitivity test in 12 cases and found it negative in each instance.

Stool examinations made in a number of cases were negative (Borley).

Borley made detailed blood studies in his cases and found eosinophilia of a low degree in 2.5 percent. One patient, returned from Samoa, had an eosinophilia of 8 percent. Tropical diseases, however, are not a factor (Hogan).

Because of the headache present in these cases, Borley did spinal punctures in eight. In six the examination was negative. One patient had a cell count of 13, another a count of 28 cells. In three instances when the spinal fluid was injected into the brain and one eye of a guinea pig a severe uveitis and exudate in the vitreous occurred in 24 hours. Injection of the spinal fluid from the other patients and also control injections were negative. Harrington did a spinal puncture in one case. Examination of the fluid was entirely negative except for a few red cells due to a slightly "bloody tap."

There also seems to be no relation to respiratory or other acute infections (Hogan).

Borley believes that the 5th nerve is also involved; that this accounts for the sensation of foreign bodies that has been described by a fairly large number of patients.

I have just received a personal communication from McGuire, who states that they have seen some of these cases on

a U.S. ship and that physical examination revealed nothing in the way of an etiologic factor.

*Area of service.* Due to the fact that the vast majority of patients had seen service in the Hawaiian Islands or the Pacific Combat Zone it was thought the disease might, in one way or another, be associated with service in these areas. The disease, however, has been found in patients who have never been in these areas and whose service has been limited to the following places: Alaska (Harrington, Borley); North Atlantic (Harrington, McAlester, Borley); Atlantic and Caribbean (Hogan); California (Lees, Stevens, Borley, Hogan) and within the limits of the United States. One case was seen at St. Mary's Pre-Flight (Borley). Lucic has seen a number of typical cases in "Boot Camp" and at examinations for enlistment. Borley states that after discussing the lesions with the Army Medical Officer at the Presidio (Letterman Hospital) in San Francisco, he is convinced that they have also seen some of these cases.

*Submarine service.* The disease has been seen in men who have been in the submarine service (Lees, Borley, Hogan). One patient, interviewed at the Oakland Naval Hospital, stated that during service they saw very little daylight and that he had never taken sunlamp treatment while aboard the submarine.

*Etiology.* Various possible etiologic fac-

tors have been discussed but thus far no conclusive cause has been established.

The patients seen early, and in fact the majority of the patients, have spent some time in the Hawaiian Islands or the Pacific Combat Zone, where there is excessive light and glare. Lees in the beginning



Fig. 3 (Cordes). Lesion larger and more regularly round. This type was seen less frequently by the various observers (R.E., vision 20/20).

considered the possibility of the lesion's being of actinic or solar origin. Many of the patients seen at Pearl Harbor were standing watch, and early in the morning or late in the afternoon were facing into the low sun across the water. Horner believed these cases to be due to excessive light. In addition to the patients who stood watch on the bridge or deck there were others who built gun emplacements or stood patrol duty on bright sand. Horner measured the light about the quarters with a Weston photometer and found it

registered 400 from wood and cement walks and that reflections from the surface of a reservoir of water went as high as 800. He further stated that "at sea when steaming into the sun it might be even worse. One must remember that cloudless skies may be encountered for weeks on end at sea." He further commented on the predominance of blonds in his series. From these statements it is apparent why most observers have given this theory serious consideration. However, the appearance of the disease in submarine crews (Lees, Borley) and in individuals whose service has been limited to Alaska, the North Atlantic, California, and other areas where there is not an abnormal amount of light (Lees, Lucic, Harrington, Stevens, Borley, Hogan) has led in most instances to the discarding of this theory.

That all these patients had one experience in common—that is, their immunization against tetanus and yellow fever—led to the suggestion by some that these inoculations might be a causative factor. Thompson, who was stationed at Mare Island before the Japanese attack on Pearl Harbor, saw a fair number of patients who all came from the Philippines or the Orient. None of this group had received the immunization injections against tetanus or yellow fever. Borley, Harrington, and other observers agree with Thompson that tetanus and yellow-fever immunization can be excluded as a cause.

Emotional upset with vasomotor instability and resultant angiospasm has also received considerable consideration, particularly from Lees, Harrington, and Hogan. Lees, who went through the "blitz" at Pearl Harbor, pointed out that during combat the nervous tension was very great and that, after being through a battle, presence in a combat zone with its resultant danger, produces the same effect. Under these conditions the men

smoke excessively. One seaman from a gun crew stated that during battle when a man is given a 5-minute period of relief it is customary to smoke one cigarette after another as rapidly as possible before going back to the station. It is possible to conceive how angiospasm might be produced under these conditions in those individuals who have an unstable vasomotor apparatus. Harrington, in his group of cases, had one patient who suggested vasomotor instability. He was unable to obtain accurate skin temperatures, but the patient had profuse sweating of feet at frequent intervals and at times his hands and feet felt cold. The patient did not smoke, which was also true in one of Lucic's cases. In the remainder of his cases Harrington was unable with the facilities at hand to obtain evidence of vasomotor instability. Hogan believes that angiospasm may explain the lesion. It may be owing to tobacco or other toxic factors. In addition, it may be caused by nervousness, fear, worry, anger, as the result of the stimulation of the secretion of adrenalin. It is also possible that there may be a combination of these factors. Hogan pointed out that many of the men not in combat zone do worry a great deal. Angiospasm would explain the variety of cases coming from different areas, different occupations, and without the history of trauma and infection. The excessive use of tobacco is very common. One patient who was very hypertonic smoked two packages of cigarettes daily. Lees and Harrington, who have also done a good deal of work in this field, concluded that vasomotor instability has not been definitely demonstrated as a cause. In Lucic's opinion worry was not a factor. Hogan, however, believes that there is sufficient evidence to support this theory to warrant further work along these lines. It is interesting to note that an Army surgeon on the Pacific Coast stated that he had seen



a good many cases of vasomotor instability with some actual Berger's disease, the number being all out of proportion to the age group. His patients were definitely affected by smoking.

Lucic believes that heredito-macular disease should receive more consideration than it has. He also noted that all of his patients, with the exception of one, gave a history of looking at arc lights, furnaces, and the like bright objects. This observation was not noted by other observers.

Borley's investigation—namely, the injection of spinal fluid into the eyes of animals with resultant uveitis in some cases—suggests a possibility, but, as he states, it is too early to form any definite conclusions.

As pointed out above, hospitalization and study have failed to reveal a common causative agent in this disease, so that the etiology is still unknown. Angiospasm, however, still warrants consideration.

*Pathology.* Hogan, who thinks that the disease is definitely on an angiospastic basis, states that, based on clinical observation, the vascular change is probably followed by exudation of fluid into the layers at the edge of the fovea and beneath the limiting membrane of the fovea itself.

The fluid is absorbed quickly, within a week at most. If it occurs within a few days there are minimal changes, with some atrophy of the conducting and supporting elements, but with no real loss of vision, so that vision of 20/20 or 20/20—is present. This, he thinks, is the usual course. If the angiospasm is more prolonged or the edema persists very long, compressing the conducting fibers, secondary degeneration results with lowering of visual acuity. If secondary degeneration occurs, holes are formed and some faint proliferation of the retinal pigment may occur, even with drusen formation.

If there is coagulation or precipitation of the edema fluid (for example, if it is albuminous) small white, sharply defined exudates are seen ophthalmoscopically.

Drusen may be formed secondary to the irritation caused by the edema fluid.

*Treatment.* All observers agree that therapy has been of little aid and that no specific treatment has been found. The therapeutic measures include fever therapy (typhoid vaccine, and others) vasodilators, calcium gluconate, iodides, thiamine chloride, and large doses of vitamin A in addition to the usual local measures employed in acute fundus disease. Harrington believes that the use of sodium nitrite and large doses of vitamin A up to 200,000 U daily did seem to be beneficial to the patients in some cases especially if they were seen early. Hogan thinks that treatment is unavailing if patients are in the chronic or regressive phase or if permanent damage has resulted. As vasodilators he used nicotinic acid, 25 mg. intravenously, twice daily, followed by hot (110°) foot baths for one-half hour to maintain the dilation. In one instance the lesion cleared within 24 hours following this treatment, whereas a similar lesion in another untreated eye did not subside for a week. Hogan also advised the discontinuance of smoking and sedation.

*Prognosis.* In general, the prognosis is good; many cases clear with 20/20 vision, even though there are possible gross macular changes (Hogan, Harrington, Borley, Lees). In some instances, however, the resulting vision may be as low as 5/200 as already pointed out. Lucic, however, made the statement that he had never seen any improvement in any case at any stage. Lees believes that in all these cases there is at least a partial permanent visual disability and that those that clear without demonstrable damage do not belong in this group.

## COMMENTS

From the data available certain comments and conclusions seem justifiable. It must be remembered, however, that this is a preliminary report.

That the disease, which was called to our attention by the Medical Officers of the Navy, is not limited to the Navy is borne out by the appearance of the condition in "Boot Camp," enlistment centers, and, in a few instances, in civilian practice.

Due to the fact that the largest number of patients observed had seen service in the Hawaiian Islands or the Pacific Combat Zone, solar retinitis received consideration as a possible diagnosis by most observers. Because of this a short discussion of the effect of our sunlight on the eye seems in order.

According to Duke-Elder<sup>1</sup> light may affect the retina in one of two ways: It may produce an abiotic effect and it may excite the sensation of vision. With the last we are not concerned here. The energy in light not used in the process of vision is absorbed by the retina.

That which reaches the retina in the form of longer waves (infrared and excess visible light) passes through the layers and is absorbed by the pigment layer of the retina, where it is degraded into heat and may produce a thermal lesion. This is evident ophthalmoscopically as a sharply defined and localized red spot accompanied by swelling and edema of the retina, together with congestion of the underlying choroid, and frequently leaving a permanently pigmented scar. This has been discussed by Harman and Macdonald,<sup>2</sup> Würdemann,<sup>3</sup> and others. Probably the most extensive work is that of Verhoeff and Bell,<sup>4</sup> who showed that the effects known as eclipse blindness are wholly thermic and are due to the intense concentration of the solar energy upon the retina by the refractive system of the eye itself, where the evidence of the de-

structive energy is located.

Clinically the immediate effect, in the milder cases, is a marked scotoma which does not pass away promptly but leaves more or less "serous cloudiness" of vision which may last a few weeks. In the severer cases the scotoma is commonly central and generally of small extent, in a large percentage of cases corresponding fairly well with the dimensions of the sun's image. Wide variations from this may result due to repeated fixations overlapping. Metamorphopsia sometimes appears. In the milder cases, with the lapse of time the scotoma tends to contract, and normal vision is regained within some weeks, whereas in the severer cases the scotoma and loss of vision are permanent. Experimentally Verhoeff and Bell were able to show that the size of the lesion is 3 mm., corresponding in size to the size of the sun's image on the retina. They also give the critical time for development of eclipse blindness as one minute or less. Based on the cases seen in the Navy, the use of the "long glass" apparently very materially shortens the time of exposure necessary to produce eclipse blindness. It seems quite apparent that the lesion under discussion does not belong in this group.

The effect of ultraviolet light upon the retina has received a good deal of consideration. The light energy that reaches the retina in the form of short waves is absorbed by the protein of the cells in its anterior layers. Here it may produce an abiotic effect. Although ultraviolet light produces less-marked action on the retina than on the tissues of the anterior segment, definite pathologic changes characteristic of abiotic action occur. The main changes are a chromatolysis and the formation of oxyphil granules in the ganglion cells and a less-marked chromatolysis in the inner nuclear layer. The majority of the abiotically active rays are absorbed by the lens. The media of

the eye protect the retina very effectively from any marked abiotic effect. In the normal eye the latent period that characterizes abiotic action makes it possible that repeated exposures over many years may eventually cause damage by a cumulative effect. Fuchs<sup>5</sup> and van der Hoeve<sup>6</sup> have presented evidence that senile macular degeneration may have such an etiology. The latter also was able to demonstrate fairly clearly that a cataract is effective in preventing this damage to the retina by deflecting the ultraviolet light. Long excessive exposure to ultraviolet light produces an acute reaction, photophthalmia (snow blindness, electric ophthalmia); but causes no material permanent changes although the immediate reaction may be very severe. Verhoeff and Bell<sup>4</sup> were able to study the condition experimentally in the human eye. The subject was a woman, aged 50 years, who was affected with carcinoma of the upper lid and orbit, necessitating removal of the eye. The eye was normal, the media were clear, and vision was 20/30. The pupil was dilated with atropine, the visual acuity remaining the same. The patient's eye was exposed to very large doses of ultraviolet light for 55 minutes. At the end of the experiment the visual acuity was reduced to counting fingers at 1 foot and erythropsia was present. Within 2½ minutes vision was fingers at 6 feet. After 10 minutes the vision was 20/200, with the appearance of a mist before the eyes but no erythropsia. After three hours, vision was 20/40+. After 22 hours, the vision was 20/30, as before the experiment. Microscopic examination showed the retina to be normal. These investigators conclude that the retina could not have been injured by abiotic action of light because of the rapid return of vision. Siegfried,<sup>7</sup> Berens,<sup>8</sup> and others conclude that the ultraviolet of daylight, even in the higher concentrations, cannot cause permanent retinal damage and that it can be

considered relatively harmless for the eye as a whole.

As has been reported, Lucic stated that with one exception all of his patients gave a history of looking at arc lights, furnaces, and so on. I was able to find only one instance in the literature, in a rather limited search, of a case in which apparent damage to the fovea was the result of arc welding. Würdemann<sup>3</sup> reported the case of a 16-year-old girl who stood at a distance of 4 to 6 feet while a workman was welding a shovel with an "electric torch." Ten days later "almost typical" Berlin's edema developed in the macula of the right eye, with radial hemorrhages. Approximately two months after the exposure to the "electric torch" the edema and hemorrhage had become absorbed, leaving a typical hole in the macula without pigment changes in the area surrounding it. There was absence of central vision together with a central scotoma. On the other hand, Rieke,<sup>9</sup> who saw 1,532 cases of welding-arc conjunctivitis in the Kaiser Shipyards between March, 1941, and April, 1943, believes that the welding arc has no effect on the retina. At first there were "frequent repeaters" and even in this group he concluded that exposure to the welding arc had no effect on the retina or deeper structures and caused no permanent damage to the eye.

From the data available at this time another theory of causation that warrants serious consideration is peripheral vascular disease with angiospasm. Hogan points out that, anatomically, the disease occurs almost exclusively in the macular area. This would tend to place the disease on a vascular basis. He further points out that the arterioles from the retinal arteries are terminal at this site and break up into capillaries near the edge of the fovea. This area is particularly susceptible to vascular changes and edema, hence the retinal capillary and arteriolar ar-

rangement must be conducive to lesions of this sort. There may be other portions of the retina affected in this disease—for example, the peripheral terminal arteriolar area elsewhere—but they cause no symptoms and the lesion goes unobserved. Hogan has seen patients who had small round punched-out areas of atrophy elsewhere in the retina without choroid involvement. He saw one patient at Treasure Island with a central lesion who also had another similar healed lesion near the inferior temporal arterioles. Similar observations were made by Flack.

In discussing macular edema Duke-Elder<sup>10</sup> states that circulatory edema is probably due to the structure of the thick fiber layer of Henle, which, with its ability to swell, can absorb large quantities of fluid, a property also shared by the retina around the disc, where the nerve fiber layer is thickest. In addition, the central area is avascular, and the absence of capillaries will limit absorption. Extreme degree of edema in the macular area may lead to the formation of cystic spaces in the retinal substance visible as small flecks. This has been variously described as "cystic macular degeneration," "honeycomb macula," or "vesicular macular edema of Nuel." Later these may form a hole in the macula.

Duke-Elder<sup>10</sup> has discussed the various forms of macular capillary disturbance under the heading of *central serous retinopathy*. This is a peculiar characteristic edema limited to the macular region in young adults. It appears as an annular swelling of a darkish-red color around the macula, usually less but sometimes disc diameter in size. The edema is essentially preretinal, so that the area is raised above the retinal level and is surrounded by a ring-shaped light reflex. There are often also small exudative dots, white to yellow, scattered over it. The condition is transient and the prognosis is relatively good, but if it persists for a longer time,

permanent pigmentary and atrophic changes remain, so that although the final vision may be 20/20 careful scotometry may reveal a small central scotoma that is not sufficiently large to become manifest in the usual tests for visual acuity. There may be slight distortion.

A number of observers have believed these cases of central serous retinopathy to be the result of vascular disease, especially angiospasm, but it remained for Horniker<sup>11</sup> to present some cases in which general and special examinations afforded evidence of vasomotor instability. He proposed the name central angiospastic retinitis, but Bailliant<sup>12</sup> called the condition capillaritis. Gifford and Marquardt<sup>13</sup> used the term central angiospastic retinopathy and stressed the absence of inflammatory evidences. It is possible that this disease is identical with the chorioretinitis centralis serosa described by Kitahara<sup>14</sup> and others. It is of interest that one Japanese writer collected 640 cases reported over a five-year period, while another reported 150 personally observed cases.<sup>15</sup> Gifford and Marquardt were also able to demonstrate vasomotor instability in their cases with evidence of peripheral vascular spasm. In their cases the effect of cigarette smoking was often marked. In one case one cigarette caused a drop of peripheral temperature varying from 6.7° to 9°F.

The disease under discussion in this report seems to correspond very closely to the central serous retinopathy of Duke-Elder, although Lees and Harrington think the name central angiospastic retinopathy would seem more applicable if peripheral vascular disease can be demonstrated. While the origin may be toxic, it is recognized that emotional upset caused by worry, fear, and the like, especially when combined with the use of tobacco, may cause angiospasm.

It has been pointed out that in the Service there is ample possibility for

emotional upset. In some of the cases, however, this can be fairly safely excluded. It is acknowledged that many of the men in the Service are excessive smokers, with cigarettes selling for 6 cents a package. In addition, while worrying or under the strain of fear, as has been stated, there is an additional tendency to excessive smoking. This combination in an individual who has an unstable vasomotor system with peripheral vascular disease unquestionably could produce angiospasm. It must be admitted that the above theory will not apply in all of the cases that have been observed. The results obtained with vasodilators when used in the very early stages would further suggest angiospasm as a basis. While this possibility has been considered by several of the Medical Officers, facilities have not been available to carry on conclusive studies in regard to possible peripheral vascular disease.

One further point warrants comment. It is possible that some of the "holes" in the fovea in patients who have normal vision may be explained by Lucic's observation that in some instances the pigment is piled up around the fovea, producing the appearance of a foveal hole.

The failure of the Army to observe the same condition more extensively may possibly be explained by the fact that visual requirements in the Navy are higher than in the Army and therefore any visual defect would be more apparent in the Navy. In a personnel whose visual requirements are not 20/20, many of the milder cases of patients, whose vision did not drop below 20/30, might easily pass unnoticed, especially as it is often difficult to differentiate early changes from a normal macula.

It has also been observed that the disease is a rarity in officers and especially in aviators. These are carefully chosen groups of men. If the angiospasm theory is accepted it seems plausible that vaso-

motor instability in these individuals would be discovered before they had completed their training and were given responsibility. As has already been pointed out, the percentage of vasomotor instability in the enlisted Army personnel apparently is high for the average age group.

No explanation has been given as to why the disease is so prevalent in the Pacific Area and not in other sectors.

### SUMMARY

This summary is based on the data furnished by the various Naval Medical Officers listed above.

The report must be considered a preliminary report.

1. Various types of macular lesions have been observed in Navy personnel. These include extensive central retinal changes due to contusion, nontraumatic macular chorioretinitis, and hole in the macula resulting from trauma or solar burns. In addition to these a rather unusual type of foveo-macular retinitis has been observed which has been found primarily in the personnel that has served in the Hawaiian Islands or the South Pacific Combat Zone.

2. Of the rather large number of cases seen, approximately 176 have been studied in detail in the various Naval hospitals to furnish the data for this report.

3. The lesion is limited primarily to the fovea and starts with a macular edema and loss of foveal reflex. In the early stages the changes are very difficult to differentiate from a normal macula. In the later stages the picture is that of a hole or cyst in the fovea surrounded by a gray area of 0.5 to 1 disc diameter in size and composed of very fine pigment changes. This may progress to a stage where the macula has a "honeycombed" appearance which, in turn, may be followed by the development of a hole in the macula. This is often irregular.

4. Various forms of treatment seem ineffective. The use of vasodilators in very early cases has in a number of cases seemed beneficial.

5. The vision varies between 5/200 and 20/20+ and while most eyes recover with 20/25 to 20/20 vision, in some instances the final vision was 5/200.

6. The average age of the patients was 23 years and the condition was bilateral in 30 percent of the cases. The second eye usually becomes involved after the first has healed.

7. In the typical case there was a central scotoma of 0.5 to 3 degrees. In some instances this disappeared even though the fovea had what appeared to be a hole.

8. Detailed physical examination failed to reveal pathologic changes that were common in any large percentage of the cases.

9. While the vast majority of patients had seen service in the Hawaiian Islands or the South Pacific, cases were also observed in "Boot Camps," enlistment centers, submarine crews, in individuals whose service has been limited to the

United States, and a few seen in private practice.

10. Of the many etiologic causes considered, only two deserve serious consideration; namely, solar retinitis and angiospastic retinopathy. The former was rather conclusively ruled out but the latter deserves further consideration.

11. Clinically the disease very closely resembles the picture of central serous retinopathy of Duke Elder, which Gifford has called central angiospastic retinopathy. Because of lack of proper facilities for this special work, it has not been possible to study these cases for the presence of peripheral vascular disease.

12. The survey seems to justify further study as to etiology, giving special consideration to possible peripheral vascular disease and angiospasm.

The report would seem rather definitely to establish an entity that appears clinically to correspond to the central serous retinopathy of Duke-Elder or the central angiospastic retinopathy of Gifford. The cause has not been established. Treatment, on the whole, has been ineffective.

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# THE CHOICE OF THE FIXATING EYE IN PARALYTIC AND NONPARALYTIC STRABISMUS\*

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Ophthalmic literature contains only occasional and fragmentary statements about the change in fixation as the eyes are directed to different parts of the fields of gaze. Tests for dominancy have generally been made in the primary position for distance and near only, and the changes in fixation in the six cardinal fields have received scant attention. Clinically, this change in fixation is frequently observed in both paralytic and nonparalytic strabismus, and operative procedures should be varied, depending on the choice of fixation.

The dominant eye is said to be the eye with the better vision, but I have observed two cases with vision of 20/200 in one eye, corrected to 20/20 with minus lenses, and 20/20 in the fellow-eye, which was practically emmetropic, yet the myopic eye was chosen to fixate most of the time, either without or with the correction, and the emmetropic eye was used only when distinct vision was necessary.

In nonparalytic convergent strabismus, especially when it is of the convergence-excess variety, several types of fixation are found. Fixation may be performed for distance, for near, and in the six cardinal fields by the eye with the better vision. In such cases the vision of the fellow-eye is below 20/70. These cases are not included in this paper. If the vision in the squinting eye is 20/70 or better, this eye will be found to fixate part of the time in some field, and the better the vision the more often the eye will be found to fixate.

When the vision is equal and the fixation is truly alternating, at least one of three different conditions is found:

First, if either eye fixates without any spasmodic inversion of the fellow-eye, and this whether fixation is in the primary position or in looking to the right or to the left.

Second, if the right eye fixates in the primary position and in eyes right, and the left eye fixates in the primary position but fixates constantly in eyes left. In such cases there is no limitation of outward rotation of either eye, but there is generally a marked increase in inward rotation of the nonfixating eye. In such cases surgical measures applied to the rectus interni to stop the overaction results in a very satisfactory correction. In these cases the convergence near point is usually either normal or excessive.

Third, in this type there may be perfect alternation in the primary position, or nearly so, or one eye may be dominant, whereas the other has a vision of 20/70 or better. In such cases either eye may fixate for distance and near, but the right eye fixates in eyes left and the left eye in eyes right. This results finally in a failure of either eye to abduct normally, and the internal recti rarely, if ever, overact, since they are, in turn, used to fixate while in the nasal field. The convergence near point is often less than normal. Surgical measures to shorten the external recti are indicated, and any surgery applied to the interni depends on the proximity of the convergence near point and the ability to hold this fixation.

The mechanics in this type evidently is as follows: while fixating with the right

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eye in the primary position, the left eye is turned  $30^\circ$  to the right. Instead of moving the right eye  $30^\circ$  to the right, fixation is taken up by the eye that is already in that position. The reverse is true when fixating with the left eye in the primary position with the right eye converged  $30^\circ$ .

In divergent strabismus, the same mechanism prevails if the strabismus is alternating; that is, with the right eye fixating for distance, the left eye is diverged  $30^\circ$  to the left and is used for vision in the left field, but when the left eye fixates in the primary position, the right eye is used for right-field fixation.

The form of surgery and the prognosis after surgical treatment depend on the correctness of the diagnosis, which must include the convergence near point, both as to whether it is absolute or relative and on how strongly the attempt is made and how well it is maintained.

I will not present any theories for the occurrence of these variations, but will state, as simply as possible, the clinical observations that I have made over a period of years.

Fixation in paralytic squints varies in much the same way, with one exception; that is, in very recent cases, where fixation with the paretic eye is uncertain and wavering, the nonparetic eye is more often used to fixate. Later the fixation may change from one eye to the other, or it may, by a tilting or turning of the head or by a control of the convergence, divergence, or sursumvergence, make binocular single vision possible. If binocular single vision cannot be maintained, then secondary contractures and secondary deviations are introduced to make the displacement of the false image either more comitant, or to make it less evident by making its displacement greater. This appears to be true regardless of whether the paralysis is hereditary or congenital or has been acquired only a few weeks or

months before the eye is examined for the first time. The contention often heard that in congenital paralyses diplopia is not present, is in most instances, a misstatement if neither eye is amblyopic. Patients will be found to adjust for fusion or for a greater displacement of the images in exactly the same way as they do when the case is recent.

In a paralysis of any extraocular muscle it must be determined which eye fixates for distance, for near, and in the six cardinal fields. These tests will determine the primary and secondary deviations and the secondary contractures, and which of these is the most marked or the most constant. The choice of the fixating eye in paralytic squints and the change from binocular single vision to monocular fixation with diplopia or suppression varies sometimes because of the dominant eye; probably more often because of the failure of the paretic muscle to fixate promptly. When the paretic muscle fixates fairly promptly, this eye is often chosen to fixate to effect a greater separation of the two images.

To illustrate: In a paralysis of the left external rectus, when fixating with the right eye, the primary deviation of the left eye may not be marked, and binocular single vision is maintained by a turn of the head into the field of the paretic externus muscle. When fixating with the right eye, a secondary contracture of the left medial rectus muscle may occur. The squint is often increased markedly and, because of the force of the internus, one cannot judge accurately the amount of the paralysis. In operating to correct an external-rectus paralysis, the internus should, whenever possible, be engaged on a double-armed suture and severed completely. Often one is able to prove that the lateral rectus is not so paretic as it was believed to be. The surgeon should make this test before asserting that a satisfactory result has been attained from

any form of transplant or other procedure. If fixation is done with the paretic eye, the secondary contracture is negligible, the main deformity being from the secondary deviation of the medial rectus of the fellow-eye.

The same principles are maintained in paralysis of the medial rectus, the greater divergence resulting from the secondary deviation of the lateral rectus of the fellow-eye, when the eye with the paretic medial rectus is chosen to fixate. This, I believe, is the reason for the marked over-corrections of convergent strabismus, when a bilateral recession or tenotomy has been performed.

In a paralysis of the superior rectus muscle, either unilateral or bilateral, if the fixation is out of the field of the paretic superior rectus, there is no secondary deviation of the inferior oblique. Only in those who fixate with the paretic eye in eyes right, and especially in eyes up and right, or in bilateral cases, with the left eye, also in eyes left and eyes up and left, is the spasm of the inferior oblique muscles excessive, and when continued over a longer period, the inferior obliques develop into especially large, powerful muscles.

In paralysis of the inferior oblique, binocular single vision may be maintained throughout a large field, and when the nonparetic eye fixates, the primary deviation may not result in marked hypotropia. When, however, the paretic eye fixates, the secondary deviation of the nonparetic eye is marked.

In a paper read by me in 1941 before the Section of Ophthalmology of the American Medical Association, I attempted to emphasize this difference in cases of double elevator paralysis of one eye. These cases are found in three forms: First, those with binocular single vision, which is maintained by a tilting of the head or by keeping the vision confined to the lower field; second, those in which

fixation is maintained by the nonparetic eye, in which case the hypotropia of the paretic eye may be more or less marked; third, those in which the paretic eye fixates. The upward rotation of this eye is more or less limited, depending on the degree of paralysis, but the secondary deviation of the nonparetic eye is excessive. In any of these varieties there may be a true or a false ptosis, the correction of which should be postponed until the eyes have been brought to approximately the same level. Paralysis of the inferior rectus muscle follows the same general rule.

Like the preceding paralyses, paralysis of the superior oblique differs, depending on whether binocular single vision is maintained in some way or whether the paretic or the nonparetic eye is used to fixate. When the nonparetic eye fixates, the inferior oblique muscle of the paretic eye usually has a secondary contracture. In these cases correction consists of performing a tenotomy or recession of the inferior oblique. This may be followed by a tenotomy or recession of the inferior rectus of the fellow-eye, in order to limit any secondary deviation. Wheeler's method of making a tuck in the superior oblique is occasionally useful, and the operation described by Wendell L. Hughes may be of use in such cases. However, when the paretic superior oblique is of the fixating eye, large degrees of deviation may be corrected by making a recession or tenotomy of the inferior rectus of the other eye, in order to stop the secondary deviation. In all of these varieties the form of surgery is dependent on the type of fixation, and surgical success depends on strict adherence to these principles.

This paper should be considered as only a preliminary study, since I have failed to test for dominance routinely, and, when tested, the results have often not been recorded.

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# THE EXOPHTHALMOS OF HYPERTHYROIDISM

A DIFFERENTIATION IN THE MECHANISM, PATHOLOGY, SYMPTOMATOLOGY, AND  
TREATMENT OF TWO VARIETIES

## *Part III*

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### EXOPHTHALMIC OPHTHALMOPLÉGIA

Before concluding this lecture, it may be not inappropriate to refer to the condition termed "exophthalmic ophthalmoplegia" (Brain, 1938). The term was invented to cover a group of cases in which exophthalmos and loss of eye movement occurred together, sometimes in association with, at others independently of, thyrotoxicosis. The condition was noted to appear spontaneously or after a thyroidectomy, but the former variety was not influenced beneficially by the operation. The characteristic feature of the syndrome was considered to be a paralysis limited to the eye muscles and not possessing the distinctive fatigability of myasthenia gravis nor showing improvement after the administration of prostigmine. The histologic basis was thought to be well recognized, consisting mainly of edema of the orbital contents and an extensive lymphocytic infiltration and fibrosis of the eye muscles.

Criticism arises in connection with the choice of term and integrity of syndrome. Concerning the first item, many varieties of proptosis coupled with disturbance or loss of eye movement occur other than those intended to be included in the term. These range from the pseudo-palsies of orbital neoplasm, inflammation, and vascular turgescence to the ophthalmoplegias of myasthenia gravis and allied neurologic disorders. The expediency of employing a nonspecific term to particularize an individual syndrome may be questioned.

Concerning the basic integrity of exophthalmic ophthalmoplegia, analysis of the illustrative cases reveals that the syn-

drome comprises examples of loss of eye movement due to thyrotoxic ophthalmoplegia and thyrotrophic exophthalmos. Elsewhere the distinction between the two conditions has been emphasized, the thyrotoxic palsy being a true ophthalmoplegia resulting from a special type of neuromuscular degeneration, whereas the disturbance of eye movement in thyrotrophic exophthalmos is largely mechanical, being due to a swelling and stiffening of the extraocular muscles that take place within the restricted confines of the orbit.

In his opening remarks, Brain draws attention to the presence in the literature of instances of hyperthyroidism associated with ophthalmoplegia. One of these, a case of Warner's (1882), was a woman, aged 25 years, with marked thyrotoxicosis and proptosis and almost total ophthalmoplegia. Autopsy three years later revealed no abnormality of the orbit apart from an increase of interfascicular fat in the voluntary muscles. Gross enlargement, edema, and round-celled infiltration were not noted. Further on, reference is made to Burch's patient in whom the loss of eye movement was accompanied by swelling, edema, and round-celled infiltration of the eye muscles. Both these cases, in spite of pathologic and clinical incongruity, are regarded as instances of one syndrome. Again, later in the article, pathologic details are given of changes in the eye muscles from two patients suffering from exophthalmic ophthalmoplegia. In one (illustrated as fig. 2 in Brain's article), changes typical of thyrotoxicosis are seen; whereas in the other, a case of postoperative progressive exophthalmos,

there is reported enlargement of the muscle fibers and rarefaction of the interstitial tissues due to edema, changes characteristic of thyrotrophic exophthalmos.

#### ANALYSIS OF ILLUSTRATIVE CASES

It may now be advantageous to examine certain of the accompanying statements:

1. (a) "Neither in exophthalmic goiter nor in exophthalmic ophthalmoplegia is the exophthalmos the result of hyperthyroidism." (b) "In Graves's disease, thyrotoxicosis is an essential; in exophthalmic ophthalmoplegia, it is not." (c) "The exophthalmos of exophthalmic ophthalmoplegia bears no constant relation to the presence of hyperthyroidism."

The object of these remarks appears intended to emphasize the author's opinion that the syndrome of exophthalmic ophthalmoplegia is to be distinguished from Graves's disease and that the development of an eye palsy in the latter condition is not related to the thyrotoxicosis. Such cases were termed "spontaneous" in contradistinction to those which follow a thyroidectomy when the basal metabolism is low. It is overlooked, concerning an instance of Graves's disease (Brain's illustrative case no. 5), that in an earlier publication (Starling *et al.*, 1938) both the exophthalmos and the ocular palsy were noted to improve after thyroidectomy.

As pointed out earlier, the proptosis and loss of eye movement of Graves's disease are essentially thyrotoxic, being somewhat related to the degree of toxicity and improved by the removal of thyroid tissue. The correct designation is thyrotoxic exophthalmos with ophthalmoplegia. On the other hand, the proptosis and loss of eye movement of thyrotrophic exophthalmos is independent of any associated hyperthyroidism.

2. "The syndrome is distinct from myasthenia gravis complicating exophthalmic goiter, points of difference being as follows: (a) The palsy is limited to the eye

muscles. (b) The myasthenic fatigability, the relapses, and remissions of myasthenia gravis are not observed. (c) There is no response to prostigmine."

Regarding limitation of the palsy to the eye muscles, it may be recalled that thyrotoxic ophthalmoplegia is not uncommonly associated with palsies of the other cranial nerves. In the earlier publication of the case referred to (Brain's no. 5), the squint was accompanied by bilateral facial and more or less generalized weakness, all items being improved or cured by a thyroidectomy. Myasthenic fatigability was also noted in that the diplopia, before its conversion into a squint, was absent for about half an hour each morning. Concerning the alleged absence of response to prostigmine, it is certain that cases of thyrotoxic ophthalmoplegia do respond to its administration, the amount depending upon the predominance of the myasthenic element over such factors as the degree of degeneration of the eye muscles, their over-lengthening, the retraction of the shortened lid tissues, and the strength of the sympathetic pull.

In thyrotrophic exophthalmos, the loss of movement is probably always limited to the eye muscles because the accompanying hyperthyroidism is seldom severe or prolonged enough to lead to generalized myasthenia. The disturbance of ocular movement also is not a myasthenic property; hence, myasthenic fatigability and response to prostigmine cannot be expected.

3. "The ocular syndrome in exophthalmic goiter is probably due to the action of the thyrotrophic hormone."

At present there is no evidence definitely implicating thyrotrophic activity in the maintenance of exophthalmic goiter, and some not unimportant against the hypothesis. Thyrotrophic exophthalmos occurs both experimentally and in man and possesses features which differentiate it completely from the proptosis of exoph-

thalmic goiter. It is hardly creditable that the thyrotrophic hormone should be responsible for both types of exophthalmos.

4. "The ophthalmoplegia is secondary to the exophthalmos."

The eye palsy in exophthalmic goiter bears no relation to the degree of exophthalmos. Full movement may be retained in the face of a considerable proptosis or, conversely, a palsy may be present with only a slight degree of proptosis. In thyrotrophic exophthalmos, the proptosis and loss of eye movement are both secondary to the muscle changes and not related to each other. The exophthalmos is not ophthalmoplegic nor the ophthalmoplegia exophthalmic.

5. "The ophthalmoplegia is a paresis or paralysis not of individual muscles but of movement in a particular plane . . . the superior rectus . . . is never affected independently of the inferior oblique."

In thyrotoxicosis, any of the individual muscles may be affected by a palsy, either singly or in conjunction with weakness or palsy of some of the others; but the loss of mobility seldom takes place solely in a particular plane. With extreme exophthalmos, ocular movement may be restricted in all directions, owing to general weakness of the eye muscles. In thyrotrophic exophthalmos, upward movement is commonly affected first, usually with upper-lid retraction. If the palsy were in a particular plane, it would be suggestive of a central lesion and the loss of upward movement would more likely be associated with ptosis.

6. "The exophthalmos is always associated with some edema of the loose tissues of the lids . . . and may be considerable."

In thyrotoxicosis, a true edema of the lids is exceedingly rare apart from an associated keratitis. Fullness of the lids not due to edema is fairly common. In thyrotrophic exophthalmos, a slight degree of edema of the conjunctiva in the

first stage and obvious edema of the lids in the second stage are usual features.

7. "Bandaging of the eyes often makes the ophthalmoplegia worse."

In exophthalmic goiter, bandaging of the eyes may result in improvement of the extraocular-muscle weakness, as it aids the retraction of muscle fibers. Bandaging in thyrotrophic exophthalmos aggravates the condition, for it increases retrobulbar tension.

8. "Its histologic basis is well recognized."

This is not quite correct. The changes in thyrotrophic exophthalmos, made familiar through the writings of Burch and Naffziger, have little in common with the thyrotoxic degeneration, but the distinction is certainly not well recognized at present.

*Conclusion.* The term exophthalmic ophthalmoplegia, being of loose definition, possessing no etiologic significance, and relating to a syndrome lacking integral unity, could appropriately be dropped for the more accurate designation of its two components; namely, thyrotoxic ophthalmoplegia and thyrotrophic exophthalmos.

#### DIFFERENTIAL DIAGNOSIS

Distinction between the well-developed case of either variety of exophthalmos is simple enough, but difficulty may be experienced in recognizing mild or atypical instances. The differential diagnosis will depend mainly upon the recognition of local characteristics, but an examination of certain general aspects will also be of aid.

Thyrotoxicosis is a disease consisting in the main of two components, thyroid overfunction and sympatheticotonia, both of which contribute in an obvious manner to the symptomatology; but it is not so readily recognized that thyrotrophic hyperthyroidism is of a more straightforward character, being accompanied only rarely by evidence of marked sympa-

thetic disturbance. Thus, the anxiety phenomena of palpitation, variable tachycardia, tremor, sweats, flushes, and anxiety traits all so characteristic of thyrotoxicosis, are usually slight or absent in thyrotrophic hyperthyroidism. Diffuse thyroid enlargement, the concomitant features of loss of weight, lymphoid dysplasia and amenorrhea, frequent associations of toxic goiter and related somewhat to the measure of toxicity, also are not common in thyrotrophism, the thyroid gland often being small and the loss of weight relatively slight. The substance of these remarks is illustrated in patients with acromegaly or in the later phases of pregnancy when the basal metabolism may be raised as much as 40 percent, due to thyrotrophic stimulation in the absence of the slightest suggestion clinically of hyperthyroidism. It may be useful, therefore, to remember that, apart from the proptosis which is capable of differentiation on its own merits, the cardinal features of exophthalmic goiter are often but little in evidence.

Other points of a helpful character concern the age and sex incidence. Thyrotoxicosis is three to four times commoner in women than in men and is mainly a disease of the young adult, although cases occur at all ages from about the third year onward. The peak of its frequency is related neither to puberty nor to the menopause. Thyrotrophic exophthalmos, on the other hand, is three to four times more common in men and possesses a higher age incidence, the average age in 22 cases in men and in 6 in women being 54 and 47 years, respectively. The disease is not often seen under 40 and is rare before 35, although there are two cases in the literature, both strangely enough in women, occurring below this figure, one at 34 years with the loss of one eye (McCravey and Mather, 1940) and the other at 31 years following the gonadothyrotrophic stimulus of pregnancy (Brain, 1939). In gen-

eral, the disease is a late menopausal manifestation, its incidence probably being related to the increased output of gonadal and less so of thyrotrophic hormones with which that period of life is associated.

Finally, satisfactory evidence of the nature of the hyperthyroid process may be obtained from an examination of the patient's serum for the presence of an increased amount of thyrotrophic hormone. The simplest, and probably most reliable, method of doing this is that practiced by Galli-Mainini (1942) and consists in estimating changes in the basal metabolism of guinea pigs treated with appropriate doses of the serum. A positive result is a sufficient indication of the thyrotrophic nature of the hyperthyroidism, although for various reasons a negative finding does not carry the same weight in the opposite direction.

Concerning the exophthalmos, however, it may be stated that in general a moderate to high degree of symptomless proptosis, often more apparent than real, of resilient character, marked by lid spasm but retaining full eye movement, and with complete absence of local edema or evidence of retrobulbar pressure is most likely to be thyrotoxic in nature; and that a slight to moderate protrusion, often painful and accompanied by other subjective phenomena, associated with retraction of the upper lid not due to spasm, often in conjunction with some loss of elevation and less frequently of lateral movement, early edema, and evidence of increasing retrobulbar pressure, is most probably thyrotrophic in origin.

#### CONCLUSION

Concerning the exophthalmos of hyperthyroidism, the existence of a differentiation complete in respect to mechanism, pathology, symptomatology, and response to treatment suggests that two diseases are concerned instead of one, as has been

the accepted opinion heretofore.

The exophthalmos of thyrotoxicosis appears to develop and be maintained independently of hypophyseal control. It often bears some relationship to the severity of the disease and tends to show improvement after thyroidectomy. The thyrotrophic hormone has never been found in increased quantities in the serum of any unquestionable instance.

Thyrotrophic exophthalmos, on the other hand, is undoubtedly of pituitary origin, being certainly associated with increased formation of thyrotrophic hormone and possibly also of one or more

sterones. Hyperthyroidism, an essential component of the condition at one stage or other, bears no more than a casual relation to the proptosis. The control of hyperthyroidism by thyroidectomy often leads to severe aggravation of the proptosis on account of the stimulus to increased secretory activity of the pituitary gland.

Thyrotrophic exophthalmos never develops into classical exophthalmic goiter; conversely, the latter is not associated with the progressive thyrotrophic exophthalmos.

### SUMMARY

A differentiation based upon distinctions in etiology, mechanism, pathology, symptomatology, and certain aspects of treatment is presented of two varieties of exophthalmos occurring in association with hyperthyroidism. The main features are as follows:

#### THYROTOXIC EXOPHTHALMOS

##### *Etiology*

A feature of young adult life, the peak being related neither to puberty nor to the menopause.

Three to four times as common in women.

A disease compounded of hyperthyroidism and sympatheticotonia and maintained apparently independently of thyrotrophic control.

##### *Mechanism*

The proptosis is essentially thyrotoxic, being somewhat related to degree of toxicity. A raised basal metabolism is associated.

#### THYROTROPHIC EXOPHTHALMOS

A feature of the climacteric, the average age in 22 cases in men and 6 in women being 54 and 47 years, respectively.

Three to four times as common in men.

A disease of pituitary origin compounded of thyrotrophism and possibly increased sterone formation. Sympatheticotonia, as in other forms of thyrotrophic hyperthyroidism, is slight or absent.

The proptosis is unrelated to any coincident hyperthyroidism. In postoperative exacerbation, the basal metabolism may be subnormal.

Unconnected with sympathetic activity. Experimentally, sympathectomy will not retard nor prevent its development. Clinically, the proptosis has appeared in an individual with paralysis of cervical sympathetic.



Produced by traction on the globe of the anterior orbital unstriated musculature operating in presence of weakened voluntary extraocular muscles. Both factors are essentially complementary.

There is no evidence of increased retrobulbar pressure.

Results from increased retrobulbar pressure occasioned by enlargement of extraocular muscles.

Later, the swollen orbital contents bulge against the orbital septum and lids, causing compression of palpebral venous arcades and leading to lid edema and chemosis.

#### *Anatomic basis of mechanism*

(a) Müller's palpebral muscles exert a pull on upper and lower poles of globe through connections with expansions from tendons of upper and lower recti muscles to lid tissues. Contraction of these muscles tends to produce lid retraction and proptosis.

Tension rises rapidly, owing to increasing lid resistance, and vicious circle of pressure leads to disaster unless relieved. Rarely, generalized introrbital edema may be associated with orbital venous obstruction.

(b) Landström's circular muscle, lying in anterior half of orbit and stretching between orbital septum and region of equator of globe, exerts direct concentric pull on globe.

#### *Component of sympatheticotonia*

Experimentally,

- (a) Stimulation of the cervical sympathetic nerve in certain animals leads to lid retraction and proptosis.
- (b) Administration of sympathomimetic drugs in subliminal dosage can effect proptosis when combined with thyroxine.

Clinically,

- (a) Exophthalmic goiter is invariably accompanied by sympatheticotonia.
- (b) The administration singly either of sympathomimetic drugs or of thyroxine will not produce exophthalmos; but the combination of the two substances can effect marked proptosis and lid retraction not accompanied by a dilated pupil.

- (c) Cervical sympathectomy may relieve the lid retraction and proptosis.

*Component of extraocular myasthenia and hypotonia*

Myasthenia is a constant accompaniment of exophthalmic goiter. It varies from the mildest type to a severe degree, simulating myasthenia gravis in its intensity and gravity. Improved by rest and administration of prostigmine, its character is somewhat altered by persistent weakness due to hypotonia.

The muscle weakness is essentially thyrotoxic in origin being cured by a thyroidectomy. It should not be confused with myasthenia gravis nor other types of myasthenia possessing a similar clinical picture.

The eye muscles are affected to a greater extent than are other skeletal muscles; hence, ocular palsies are relatively not infrequent. The predilection may be accounted for by the fine structure of the muscle fiber which is unique in the body, by their greater susceptibility to chemical and presumably thyroid toxemia, and by widespread degeneration of highly developed nerve supply.

A correlation has been established between the degree of myasthenia and exophthalmos present.

Administration of prostigmine may temporarily reduce the width of the palpebral fissure and improve slightly the degree of proptosis. Thyrotoxic ophthalmoplegias have also been relieved temporarily by this drug.

Alternatively, the administration of yohimbine may reduce the proptosis produced experimentally by the combined effect of ephedrine and thyroxine. Both these drugs favorably influence muscle tone although in different ways.

*Orbital pathology*

A neuromuscular degeneration.

The morbid process is characterized by:

(a) General wasting of muscle fibers accompanied by loss of striation, fibrillation, amorphous granulation of sarcoplasm. Marked reduplication of sarcolemmal nuclei and less so those of sarcoplasm.

(b) The nerve fibers show granulation and absorption of neuroplasm accompanied by diffuse proliferation of neurilemmal nuclei.

Each type of degeneration in scattered areas may lead to disintegration and absorption of respective fibers.

Muscles normal in size and consistence.

Absence of edema, general fibrosis, and round-celled infiltration. A few small lymphorrhages seen.

Lacrimal gland normal.

Orbital fat normal or slightly increased.

Nutrition of eyeball little impaired; congestion absent, except as result of exposure.

*Symptomatology*

A symptomless proptosis with features depending mainly on sympathetic overaction and extraocular weakness.

Subjective features absent, as a rule, except when due to complication or exposure.

Lid spasm evident.

Primarily a muscle disorder.

The morbid process is characterized by:

(a) Diffuse and extensive fibrosis.

(b) Edema.

(c) Special type of degeneration resulting in fibrosis or disintegration and absorption of muscle fibers.

(d) Abundant round-celled infiltration.

Smaller nerves and vessels affected by edema. The former become absorbed.

Muscle enlargement may be gross, sometimes attaining circumference of 60 to 70 mm.

Consistence hard and gritty.

Absence of sarcolemmal nuclear reduplication.

Lacrimal gland constantly affected by changes similar to those in muscles.

Orbital fat normal or reduced.

Nutrition of eyeball suffers through congestion, chemosis, and ulceration. Perforation, papilledema, and retinal hemorrhages not infrequent.

An uneasy proptosis with many features resulting mechanically from increased retrobulbar pressure.

Subjective phenomena frequent and early, consisting of discomfort or pain, lacrimation, photophobia, diplopia, and difficulty in convergence.

Lid spasm absent, permitting eversion of lids in early stages.

Proptosis more apparent than real, owing to associated widening of palpebral fissure.

No evidence of increased retrobulbar pressure. The globe can often be pushed back into orbit by firm and gentle pressure although quickly resuming former position on release of pressure.

Congestive features absent except as result of exposure.

Lid edema and chemosis never seen apart from anasarca or local sepsis due to ulceration.

Ulceration rare and usually of superficial type unless complicated by sepsis.

Dislocation of globe not rare in high degrees of proptosis, owing to wide palpebral fissure and laxity of extraocular muscles.

Eye movement normal but palsies of individual muscles may occur. Ptosis and disturbance of lateral movement most common, but rarely total ophthalmoplegia occurs, usually in association with some generalized myasthenia.

Eye palsies sometimes relieved by prostigmine and cured by thyroidectomy.

Vision normal, although slight restriction of extreme temporal fields, owing to weakness of ocular abductors.

Lacrimal gland normal.

#### *Treatment*

Proptosis improved or not altered by thyroidectomy. Never made worse by op-

Proptosis more real than apparent owing to absence of lid spasm.

Retrobulbar tension hard, sometimes stonily resistive. The globe cannot be pushed back into orbit, and attempt is painful.

Congestive features early and constant, manifested first by subedema of ocular conjunctiva and presence of network of fine venules.

Lid edema and chemosis consecutive to compression of palpebral venous arcades and lid pressure over cornea.

Ulceration almost inevitable in severe cases; results from corneal necrosis due to lid tension and exposure. It is deep and rapidly perforates unless relieved.

Dislocation of globe almost impossible owing to lid tension and bulk of extraocular muscles.

Eye movement affected early, due partly to mechanical hindrance, partly to muscle degeneration. Upward movement disturbed early and most frequently, usually associated with upper-lid retraction. Lateral movement less affected, depression least of all. Total immobility not uncommon.

Loss of eye movement not altered by prostigmine, often worse after thyroidectomy.

May be general constriction of fields due to disc changes. Consecutive optic atrophy may follow.

Lacrimal gland palpably enlarged.

Proptosis seldom improved by operation, may be exacerbated due to thyro-

eration. Postoperative progression means insufficient removal of thyroid gland.

Not altered by iodine administration, made worse by thyroid medication.

Not affected by pituitary irradiation.

Tarsorrhaphy useful for ulceration. If sepsis present, tension must be relieved.

trophic stimulation. Experimentally, thyroidectomy facilitates development of thyrotrophic proptosis.

Improved by iodine and thyroid administration.

Usually improved by pituitary irradiation.

Tarsorrhaphy dangerous for ulceration; may hasten loss of eye. Immediate orbital decompression required.

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# INCLUSION BLENNORRHEA

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## PART I. MANIFESTATIONS IN THE NEWBORN

The clinical manifestations of inclusion blennorrhea of the newborn have been described in a number of reports<sup>1-15</sup> of small series of cases. In view of this fact, agreement concerning the general features of the disease has been surprisingly good. However, further information is needed concerning the sex distribution, seasonal variation, occurrence of lymphadenopathy, manifestations and changes in the chronic phase, and other minor aspects of the disease. Therefore, in order to supply some of these data and in order to establish a basis of comparison for experimental studies to be reported subsequently, the following analysis of another series of cases of inclusion blennorrhea of the newborn is presented.

*Incidence.* In the six years which have elapsed since Thygeson<sup>13</sup> completed his studies on ophthalmia neonatorum in Iowa, 43 cases of inclusion blennorrhea of the newborn have been observed in the University Hospitals. Seven of these babies were delivered outside the Hospital and were referred for treatment. The other 36 were born in the University Hospitals in the course of 9,580 deliveries, thus giving the disease an incidence of 0.37 percent in the newborn, or an incidence of approximately 10 percent of cases of ophthalmia neonatorum.

The incidence among the two sexes was approximately equal; 23 of the babies were males and 20 were females.

Neither Thygeson<sup>13</sup> nor Julianelle and Lange<sup>14</sup> were able to demonstrate a seasonal variation in the incidence of inclusion blennorrhea. Likewise in this series the distribution was random rather than seasonal (see table 1).

Symptoms appeared simultaneously in both eyes in 30 cases but in 12 cases one

TABLE 1  
SEASONAL INCIDENCE OF INCLUSION  
BLENNORRHEA

Month	Number of Cases		Number of Deliveries
	Total	Born Univ. Hosp.	
January	4	4	828
February	5	5	765
March	4	3	897
April	4	4	813
May	3	3	828
June	7	6	813
July	4	3	868
August	2	1	812
September	2	1	828
October	4	4	716
November	2	1	696
December	2	1	716
Totals	43	36	9,580

eye was involved first and in one case the infection remained confined to one eye.

Among the 30 cases in which the onset was bilateral, there were two infants who had obstructed nasolacrimal passages. The obstruction was relieved by irrigation on two consecutive days in one case and on three consecutive days in the other. Three other infants had secondary bacterial infection; in one the microorganism was *Streptococcus viridans*; in one, *Staphylococcus aureus*; and in one *Neisseria gonorrhoeae*. Treatment of the streptococcic and staphylococcic infections with 0.5-percent silver-nitrate oint-

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ment three times a day for four days eliminated the bacteria but apparently had little effect on the course of the inclusion blennorrhea. However, data from these five cases are not included in the statistics on the course of the disease. The case complicated by gonorrheal ophthalmia will be discussed in a subsequent report.\*

*Incubation period.* The incubation period, measured from time of birth to the

TABLE 2  
INCUBATION PERIOD

Onset (days after birth)	Number of Cases
5.....	3
6.....	2
7.....	11
8.....	14
9.....	4
10.....	6
11.....	1
15.....	2

first appearance of symptoms, varied between 5 and 15 days, with an average of 8 days (table 2). In the 12 cases in which unilateral involvement was followed by symptoms in the other eye, the interval between involvement of the two eyes varied between one and seven days with an average of three days (table 3).

*Course.* (It was impossible to keep the cases under observation during the entire course of the disease but all were observed for several days after the maximum reaction developed and 11 cases

TABLE 3  
INTERVAL BETWEEN INVOLVEMENT OF  
FIRST AND SECOND EYES

Days	Number of Cases
1.....	5
2.....	2
5.....	2
6.....	1
7.....	2

\* Part III (to be published later).

were observed at frequent intervals until the conjunctiva returned to normal. In 16 cases the course of the disease was altered by sulfonamide therapy.)†

The first sign of the disease, usually, was a small amount of purulent discharge at the inner canthus of one or both eyes. At that time a moderate reddening of the conjunctiva was observed. These signs increased in intensity and were followed by edema of the lids, subconjunctival infiltration, papillary hypertrophy, and preauricular adenopathy. This period of intensification of the manifestations was called the developmental phase. In 26 cases this phase lasted 24 to 36 hours, in 8 it was prolonged, varying between 60 hours and 6 days; but in 9 cases it was short, lasting only a few hours (table 4).

The development of maximum reaction marked the beginning of the acute phase, which was divided into two general

TABLE 4  
MODE OF ONSET AND SEVERITY OF SIGNS

Onset	Number of Cases	Manifestation in Acute Phase	
		moderate	severe
Gradual	8	5	3
Rapid	26	15	11
Sudden	9	5	4
Total	43	25	18

groups: moderate and severe. Apparently severity of manifestations in the acute phase was not related to rapidity of onset, for even though the developmental phase in eight cases was gradual, three eventually developed hyperacute manifestations (table 4).

The moderate group of the acute phase was characterized by purulent discharge and occasional thin pseudomembranes on the conjunctiva; edema of the lids, particularly of the lower lid; infiltration of

† See part III.

the conjunctiva of the lower lid and fornix; papillary hypertrophy; slight chemosis of the conjunctiva, especially of the lower lid and fornix; and preauricular adenopathy in some of the cases (15 in 25). Eversion of the lower lid resulted in exposing a thickened, longitudinally corrugated and bulging lower fornix.

The severe\* cases of the acute phase were characterized by the same general manifestations but were more intense. In each case the purulent discharge was profuse, and pseudomembranes 1 to 2 mm. thick were observed on the conjunctiva. Edema of the lids was more extensive and involved the upper as well as the lower lid. Conjunctival chemosis and infiltration extended into the upper fornices. Eversion of either lid resulted in bulging outward of the corresponding infiltrated and corrugated fornix and caused slight bleeding from the conjunctiva. However, the greater amount of pathologic change was in the lower fornix. Preauricular adenopathy was present in each case.

In the acute phase purulent discharge was observed in all cases. Pseudomembranes occurred in 29 cases, being present in all of the severe ones and in 11 of the 25 moderate cases. Edema of the lids and conjunctival infiltration were present in all cases. Preauricular adenopathy was not observed in 10 of the 25 moderate cases but was found in all of the severe cases.

Eleven uncomplicated and untreated cases were followed through their acute phases and at frequent intervals thereafter until the conjunctivas were normal. The acute phase gradually subsided into a chronic phase which, after a much longer time, eventually disappeared, leaving a normal conjunctiva.

The acute phase was considered at an end when edema of the lids and chemosis

of the conjunctiva had disappeared. This averaged 21 days with extremes of 14 and 30 days. Pseudomembranes disappeared before the end of the phase. In the moderate cases pseudomembranes were present 2 or 3 days, whereas in the more severe cases they persisted 7 to 12 days and in one case thin pseudomembranes were present as late as on the seventeenth day.

The purulent discharge became less profuse and as the acute phase passed over into the chronic, the discharge changed from purulent to mucopurulent. In one instance discharge persisted for four months, although the average was 60 days and the shortest duration was 25 days. Preauricular lymph nodes were palpable 30 to 38 days, or an average of 32 days. Conjunctival infiltration disappeared from the eyes of two infants in 30 days but persisted for 120 days in another. The average duration was 59 days. Follicles were observed in 9 of the 11 babies between two and three months after onset of the disease. A few follicles were observed in the subconjunctival tissue of the upper lid and fornix, but the majority were located in the lower lid and fornix. Duration of the follicular reaction varied between 2 and 10 months, with an average of 5.5 months.

The total duration of the disease averaged 7 months with extremes of 2 and 12 months.

*Complications and Sequelae.* During the acute phase the eyes in all cases were examined, with loupe magnification, for corneal complications. In several of the more severe cases, application of fluorescein resulted in a few minute superficial staining areas, but these were transitory and left no opacity. Infiltrates and vascularization were not observed.

Scarring of the conjunctiva did not occur in the 11 cases followed throughout

\* Designated hyperacute by Thygeson.

the course of the disease. Nor was it observed in nine other infants of this series examined between 18 and 24 months after birth. Thick pseudomembranes had been present in the acute phase in six of this group.

*Laboratory studies.* In all cases repeated cultures were made upon blood-agar plates, and in the severe cases upon chocolate-agar and Loeffler's slants. Except in the three cases mentioned, no pathogenic bacteria were grown. In approximately half of the cultures numerous colonies of *C. xerosis* and in several cultures nonhemolytic colonies of *Staphylococcus albus* were observed after 24- to 48-hours' incubation. Approximately one half of the cultures revealed no growth of bacteria.

Duplicate secretion smears were made and stained with Giemsa or Wright's stain and by the Hucker modification of the Gram technique. These were found to be of little value except in the three cases complicated by secondary bacterial infection.

Scrapings of the conjunctiva were taken from the lower fornix in all cases and from the upper fornix in approximately half of the cases. The material was smeared upon clean glass slides, fixed overnight in absolute methyl alcohol, and stained for one hour at 37°C. in dilute Giemsa stain. Typical inclusion bodies were found on the slides from the lower fornix of each patient. Similar inclusion bodies were found on the slides prepared from the upper fornix only in those cases exhibiting the severe type of involvement, and in general the number of inclusion bodies was roughly proportional to the severity of the disease. Inclusion bodies were demonstrable from the lower fornix in one case 30 days after onset of the disease, and in another case for 123 days, but, on the average, this time element

comprised 66 days.

In addition to epithelial cells, slides made from conjunctival scrapings revealed many polymorphonuclear leucocytes during the acute phase, but as the profuse discharge subsided the absolute and relative number of neutrophils diminished. Small lymphocytes were present on all slides and their absolute number seemed to remain approximately constant, although they were relatively more numerous as the purulent discharge decreased. Plasma cells were observable during the subacute and chronic phases. Occasional large monocytes were seen during the first few days of symptoms but during the latter part of the acute phase these cells increased in number, and evidence of their macrophagic activity was observed (fig. 1).

Teased and smear preparations were made of some of the thicker pseudomembranes. They were found to consist of many polymorphonuclear leucocytes and a few small lymphocytes caught in a fibrin meshwork. An occasional epithelial cell was seen in the mass but no bacteria were found.

Conjunctival biopsies were made in eight infants, and the pathologic changes reported by Braley<sup>16</sup> in a separate paper, in which he also reported a study of biopsies from the cervix of mothers of six of the infants.

Scrapings of the cervical epithelium of 29 of the mothers, including the six reported by Braley,<sup>16</sup> were examined after preparation with Giemsa stain. Inclusion bodies were demonstrated in 27. In one of the two cases in which inclusion bodies were not found the mother, because of a postpartum infection, had been receiving large doses of sulfanilamide for seven days before the cervical scraping was made.

*Differential diagnosis.* Gonorrheal oph-

thalmia and staphylococcic conjunctivitis of the newborn are the principal lesions to be differentiated from inclusion blennorrhea.

From the clinical aspect gonorrheal ophthalmia usually begins on or before the fifth day of life; edema involves both lids; chemosis involves the bulbar conjunctiva, the fornices, and the palpebral

differentiation, particularly in instances of the rare mixed infections. However, clinical diagnosis should be confirmed by laboratory methods in every case of conjunctivitis, especially in every case in which gonorrheal ophthalmia must be considered.

In gonorrheal ophthalmia secretion smears and scrapings reveal Gram-negative intracellular diplococci. Cultures from



Fig. 1 (Allen). Large mononuclear phagocytes from cases of inclusion blennorrhea of the newborn.

conjunctiva of both lids; a profuse dirty greenish-yellow discharge usually streams over the lids; and dirty pseudomembranes are frequent. Staphylococcic conjunctivitis may begin any time after birth; edema of the lids usually is less extensive; chemosis usually involves the conjunctiva of the lids and fornices but not of the globe; the profuse discharge is usually pure yellow; and pseudomembranes are white or yellowish white when present. Inclusion blennorrhea usually begins after the fifth day of life; edema of the lids, chemosis and infiltration of the conjunctiva usually are limited to the lower lid and fornix or are more severe there; a profuse pure-yellow discharge flows over the lids; and clean white or grayish white pseudomembranes are frequent.

This clinical differentiation should distinguish the majority of cases but at times laboratory aids are necessary for final

the conjunctiva, made on chocolate-agar plates and incubated under 10-percent carbon-dioxide tension, produce small, clear, or semi-opaque colonies of *N. gonorrhoeae* after 48 to 60 hours. In staphylococcic conjunctivitis smears and scrapings reveal Gram-positive cocci arranged singly, in pairs, or in small clusters in the secretion or on the surface of cells. Cultures from the conjunctiva made on blood-agar plates and incubated aerobically produce in 24 hours opaque, yellow or white, flat or dome-shaped colonies which are surrounded by a zone of clear hemolysis. In inclusion blennorrhea conjunctival scrapings prepared with Giemsa stain reveal initial body, elementary body, or mixed inclusion bodies in the cytoplasm partially surrounding the nuclei of epithelial cells.

In certain instances and in certain geographical localities a differentiation be-

tween inclusion blennorrhea and trachoma may be necessary. In trachoma manifestations are most intense in the upper fornix and upper lid. Corneal infiltrates and pannus formation appear early. In inclusion blennorrhea pathology is maximal in the lower fornix and lower lid. Corneal infiltrates and pannus do not occur.

*Discussion.* The incidence of inclusion blennorrhea in the newborn seems compatible with previous reports in the literature. However, the sex incidence, 23 males and 20 females, is in contrast with Lumbroso's report<sup>8</sup> of 10 females and 4 males and Julianelle and Lange's report<sup>14</sup> of 15 females and 7 males. This discrepancy should, perhaps, be expected in dealing with small numbers of cases; for example, during the first 12-month period of this study 7 females and 2 males were observed, but during the second 12-month period the ratio was 3 females to 9 males. Therefore, sex distribution probably will parallel the birth rate of the sexes when adequate statistics have been compiled.

The incubation period is similar to that in previously reported series. However, in 12 cases involvement of one eye was followed in one to seven days by involvement of the second eye (table 3). In Thygeson's series<sup>13</sup> the second eye was never involved in less than five days. This he felt was compatible with transfer of infectious material from the first to the second eye. In this series seven cases showed involvement of the second eye one or two days after the first. The only explanation which can be offered in these cases is that the inoculation occurred at the same time but the inoculum for the first eye was larger than that for the second, and, therefore, the incubation period varied by one or two days with the size of the inoculum. For those five cases in which the second eye became involved 5, 6, or 7 days after the first, contamination

by infectious material from the first eye seems to be the more logical explanation.

The course of the untreated cases in this series followed the pattern of previous descriptions of the disease. However, the acute phase apparently persisted several days longer than has been reported by all other observers except Lumbroso.<sup>8</sup>

The apparent severity of the disease in its acute phase is out of all proportion to its good prognosis. Each of the seven cases referred to the Hospital for treatment after outside delivery was diagnosed gonorrheal ophthalmia even though the referring physician had failed to find gonococci in smears from the conjunctiva.

The pseudomembranes were removed easily and without leaving bleeding points. However, in the more severe cases in which heavy infiltration of the subconjunctival tissue occurred, only slight manipulation of the lid was required to produce a sanguineous discoloration of the discharge.

Enlargement of the preauricular lymph nodes roughly was proportional to the severity of the conjunctival pathologic change. The enlarged nodes were moderately firm and there was no discoloration of the overlying skin.

Bacteriologic examinations were made several times in each case, but pathogenic bacteria were found in only three cases. In two of these, inclusion bodies persisted in the epithelial cells and the course of the disease was unaffected even though the pathogenic bacteria were eliminated from the conjunctiva. These facts support the contention that inclusion blennorrhea is an infectious disease not of bacterial origin but probably of virus etiology.

Inclusion bodies were found in scrapings from both the upper and lower fornix in severe cases but only in scrapings



from the lower fornix (that is, the site of maximum pathologic change) in the mild cases. This distribution should be remembered particularly when one is attempting to make a diagnosis in mild cases or attempting to determine the presence or absence of inclusion bodies in the evaluation of therapy. This distribution of the inclusion bodies also suggests that they are associated with the etiologic agent of the disease.

The presence of large mononuclear cells showing macrophagic activity (Leber cells) has not been stressed in previous reports. Cells of this type were seen in practically all scraping preparations. They were never very numerous but three to six were found in the average search for inclusion bodies in a scraping preparation.

Two of the infants in the series were the first-born of twin births. In both instances the second twin did not develop inclusion blennorrhea, yet 10 or 11 days after delivery cervical scrapings from the two mothers revealed inclusion bodies.

*Summary and Conclusions.* In a six-year period 43 cases of inclusion blennorrhea of the newborn were observed. Thirty-six of these occurred in the course of 9,580 consecutive deliveries, thus giving the disease an incidence of 0.37 percent in the newborn. However, this group of cases accounted for approximately 10 percent of ophthalmia neonatorum observed during the six years.

2. In contrast to previous reports inci-

dence in the sexes was approximately equal.

3. There was no apparent seasonal variation in incidence.

4. Culture studies in these cases substantiate the conclusion that the disease is not of bacterial origin.

5. The distribution of inclusion bodies in relation to maximal pathologic change suggests that they are associated with the etiologic agent.

6. The disease was divided into three phases: developmental, acute, and chronic. The developmental phase varied between a few hours and six days. The acute phase averaged 21 days but varied between 14 and 30. The chronic phase persisted for several weeks to several months, thus making the total duration average 7 months with extremes of 2 and 12 months.

7. Transitory, superficial, punctate, epithelial staining of the cornea occurred in several of the severe cases during the acute phase.

8. Corneal infiltrates and vascularization of the cornea did not occur.

9. Folliculosis occurred 2 or 3 months after the onset of the disease in 9 out of 11 cases and lasted 2 to 10 months (average 5.5).

10. Mononuclear macrophages (Leber cells) were observed in scraping preparations. They were more numerous and apparently more active in the latter part of the acute phase.

11. Cervical scrapings, made from mothers of 29 infants in this series, revealed inclusion bodies in 27.

## PART II. MANIFESTATIONS ON CONSECUTIVE CONJUNCTIVAL PASSAGE

Lindner has proposed that inclusion blennorrhea and trachoma originally were the same benign disease. He believes the virus of inclusion blennorrhea has remained benign because of its frequent passage through mucosa of the male or female genital tract. On the other hand,

he believes that the virus of trachoma has become adapted to the conjunctiva as a result of continuous eye-to-eye transmission, and in its adaptation has changed its disease-producing characteristics and has increased its virulence.

This theory has been contested by

Gebb,<sup>17</sup> Löhlein,<sup>18</sup> Morax,<sup>19</sup> Thygeson,<sup>11</sup> and others on the basis that accidental and experimental inoculations with material containing the infectious agent of inclusion blennorrhea have produced swimming-bath conjunctivitis and no trachoma. However, several of these observations were the result of single inoculations; thus no time was allowed for adaptation of the infectious agent to the conjunctiva and the observations therefore offer an inadequate basis for contesting the theory. Therefore, to test Lindner's hypothesis and to make some other observations, which will be reported later, a series of consecutive conjunctival passages of inclusion blennorrhea have been made.

At the time of this report, 40 consecutive passages have been made. Thirty-five of the subjects were observed until several days after the development of maximal manifestations, then were used for therapeutic studies.\* However, five untreated control cases have been observed throughout the entire course of the disease.

*Materials and Procedures.* Children between three and nine years of age were selected as subjects for the passage studies after examination of their eyes revealed: normal lids, conjunctivas, and corneas; patent nasolacrimal passages; and after cultures of the conjunctivas failed to grow pathogenic bacteria.

Infectious material for the first passage was obtained from a case of inclusion blennorrhea of the newborn without secondary bacterial infection. The infant had developed signs of the disease on the morning of the tenth day of life. Within a few hours the conjunctival manifestations had reached their maximum and were considered moderate (part I). Cul-

tures made on the morning of the tenth day grew several colonies of *C. xerosis*, but no pathogenic bacteria. Conjunctival scrapings from the infant and cervical scrapings from the mother revealed inclusion bodies. Cultures from the mother's cervix were free from pathogenic bacteria. Scrapings of the conjunctiva made approximately 48 hours after the development of maximal signs were used as the inoculum in the first passage.

The second and subsequent passages were made after the subject of the preceding inoculation had developed maximal manifestations. Direct transfer of infectious material from the conjunctivas of one subject to the next was made by means of conjunctival scrapings. In each case a sterile platinum spatula was drawn over the infected conjunctiva several times in the same manner as is used in obtaining material for microscopic examination. Then the material was deposited upon the normal conjunctivas by gentle massage with the spatula. Immediately after the transfer was made similar scrapings were smeared upon glass slides and prepared for microscopic examination with Giemsa stain. Study of these slides gave a rough index of the relative number of inclusion bodies transferred.

Conjunctival cultures and scrapings were made at 2- to 4-day intervals throughout the period of observation of the 35 cases eventually used for therapeutic studies. In 5 untreated cases laboratory examinations were made at 2- to 4-day intervals for the first 30 days and at weekly intervals thereafter.

*Results.* Following inoculation each of the 40 subjects developed conjunctival inflammation typical of that which has been described as swimming-bath conjunctivitis or inclusion blennorrhea of the adult. Moderate to profuse purulent dis-

\* To be reported as part III.

TABLE 5

INCUBATION PERIOD, ONSET AND ACUTE MANIFESTATIONS OF 40 CONSECUTIVE CONJUNCTIVAL TRANSFERS OF INCLUSION BLENNORRHEA

Passage Number	Incub. Period	Onset	Acute phase	Pseudo-membranes	Discharge	Edema of Lids	Conjunctival Infiltration	Preauricular Adenopathy
I	7	abrupt	moderate	+	+++	+	++	+
II	5	abrupt	moderate	0	+++	+	++	+
III	5	abrupt	moderate	+	+++	+	++	+
IV	12	abrupt	moderate	0	+++	+	++	+
V	10	gradual	moderate	0	+++	+	++	+
VI	5	abrupt	moderate	+	+++	+	++	+
VII	5	abrupt	severe	++	++++	++	+++	++
VIII	5	abrupt	severe	++	++++	++	+++	++
IX	5	abrupt	severe	++	++++	++	+++	++
X	12	gradual	moderate	0	+++	+	+	0
XI	7	abrupt	severe	++	++++	++++	+++	++
XII	6	abrupt	moderate	+	+++	++	++	++
XIII	7	abrupt	severe	++	++++	++++	+++	+++
XIV	9	gradual	moderate	0	+++	+	+	0
XV	5	abrupt	moderate	+	+++	++	+	+
XVI	5	abrupt	moderate	+	+++	++	+	+
XVII	6	abrupt	severe	+++	++++	++++	++++	+++
XVIII	7	abrupt	severe	+++	++++	++++	++++	+++
XIX	7	gradual	moderate	+	+++	++	+	+
XX	6	abrupt	severe	++	++++	++++	++++	+++
XXI	4	abrupt	severe	++	++++	++++	++++	+++
XXII	8	abrupt	severe	+++	++++	++++	++++	+++
XXIII	13	abrupt	severe	++	++++	++++	++++	+++
XXIV	8	abrupt	severe	++	++++	++++	++++	+++
XXV	8	abrupt	severe	++	++++	++++	++++	+++
XXVI	15	abrupt	severe	+++	++++	++++	++++	+++
XXVII	5	abrupt	severe	+++	++++	++++	++++	+++
XXVIII	7	abrupt	severe	++	++++	++++	++++	++
XXIX	5	abrupt	severe	+++	++++	++++	++++	++
XXX	12	abrupt	severe	+++	++++	++++	++++	+++
XXXI	7	abrupt	severe	++	++++	++++	++++	+++
XXXII	4	abrupt	severe	++	++++	++++	++++	+++
XXXIII	5	abrupt	severe	++	++++	++++	++++	+++
XXXIV	14	abrupt	severe	++	++++	++++	++++	+++
XXXV	9	abrupt	severe	++	++++	++++	++++	++
XXXVI	11	gradual	moderate	0	+++	++	++	+
XXXVII	11	abrupt	moderate	+	+++	++	++	+
XXXVIII	8	abrupt	severe	++	++++	++++	+++	++
XXXIX	9	gradual	moderate	0	+++	++	++	+
XL	10	abrupt	moderate	+	+++	++	++	+

charge was accompanied in many cases by false membranes upon the conjunctiva. The lids were edematous; the subconjunctival tissue was infiltrated; and there was some swelling of the conjunctiva. Upon eversion of the lid the conjunctiva of the lower fornix bulged outward and presented the ruga-like appearance characteristic of the mucosa of the rectum. Follicles were present and the preauricular lymph nodes were palpable.

The intensity of these manifestations varied among the 40 cases but in general

was considered moderate in 16 cases and severe in 24. The distinction between moderate and severe was the same as described for the newborn (part I).

*Incubation period.* The time between the inoculation and the appearance of first signs of conjunctival inflammation varied between 4 and 15 days (table 5). The average was 7.7 days, which was practically the same as was found in inclusion blennorrhea of the newborn (8 days, part I).

*Onset.* The developmental phase was either gradual or abrupt. In 6 cases development of maximal signs required from 2 to 6 days after the appearance of conjunctival discharge and redness, whereas in 34 cases maximal inflammatory signs appeared within a few hours. The nature of the onset was not related to the length of the incubation period, for the 6 cases in which onsets were gradual had incubation periods varying between 7 and 12 days, and the cases manifesting

and only thin ones were seen in the remainder, whereas, thin-to thick pseudomembranes were observed in all severe cases. Preauricular lymph nodes were not palpable in 2 of the moderate cases but were slightly enlarged in 11 cases and easily palpable in the remaining 27 cases. Edema was present in the lower lids in all cases and extended into the upper lids in the more severe cases. Conjunctival chemosis and infiltration was present in the lower lid and fornix in all cases and ex-

TABLE 6  
DURATION OF SIGNS IN CONTROL CASES

Passage No.	Acute Phase (days)	Pseudo-Memb. (days)	Edema of Lids (days)	Preauricular Adenopathy (days)	Conj. Infiltration (days)	Discharge (days)	Inclusion Bodies (days)	Follicles (months)
I	14	2	14	10	28	29	63	3
II	16	0	16	18	29	32	63	3
XV	19	2	19	21	31	33	63	5
XXV	30	7	30	35	61	70	70	7
XXXIII	26	5	26	31	49	56	63	6
Average	21	3	21	23	39	44	64	5

the three longest incubation periods had abrupt onsets.

*Course.* Because the majority of these cases were used for therapeutic studies (part III) several days after the development of maximal manifestations, the entire course of the disease was followed in only five control cases. These were passage number I, II, XV, XXV, and XXXIII, selected as controls because three were moderate and two were severe.

Following the developmental phase, an acute phase similar to that described for the newborn ensued. However, in the experimental cases follicles appeared during the acute phase. They were observed between the third and fifth days of the disease and in general were seen earlier in the 16 moderate cases than in the 24 severe ones. Pseudomembranes were not observed in seven of the moderate cases,

tended into the upper lid and upper fornix in the more severe cases.

In the 5 control cases, which were allowed to run their courses without therapeutic interference, the acute phase persisted for 14, 16, and 19 days in the moderate cases and for 26 and 30 days in the severe cases, or an average of 21 days (table 6). Pseudomembranes did not appear in one case but persisted 2 to 7 days in the others. The preauricular lymph nodes were palpable for an average of 23 days and conjunctival infiltration was observed for an average of 39 days. Discharge, profuse at first, diminished toward the end of the acute phase, became mucopurulent, and disappeared after 44 days on the average (table 6).

The duration of the chronic phase and total duration of the disease were determined by the disappearance of follicles. In these 5 cases follicles persisted ap-

proximately 3, 3, 5, 6, and 7 months, respectively, or an average of 5 months.

*Symptoms.* A sensation of irritation of the eyeball or a foreign-body sensation usually preceded the appearance of discharge by two or three hours, and generally persisted throughout the acute phase. During the period of maximum reaction all of the subjects complained of slight photophobia for three or four days. The lower lids were slightly tender during the acute phase but were never painful. Enlargement of the preauricular lymph nodes was not associated with pain or tenderness. However, the most annoying symptom was the discharge.

*Complications.* The corneas were examined at frequent intervals by means of the slitlamp and biomicroscope. During the period of maximum reaction eight of the subjects with photophobia were found to have many fine, superficial, grayish-white opacities of the corneal epithelium. After rapid staining with fluorescein, these opacities retained the green color. They were found close to the limbus and were more numerous in the lower portion of the cornea; but they were transitory, never being demonstrable for more than two days. There was no evidence of corneal infiltrates nor of extension of superficial or deep vessels into the cornea, at any time in any of the cases. Conjunctival scarring did not occur.

*Laboratory studies.* Corynebacteria, with culture characteristics of xerosis, and nonhemolytic colonies of *Staphylococcus albus* were grown in approximately one half of the conjunctival cultures. However, pathogenic bacteria were cultivated from the inflamed conjunctiva in only four cases. Subject XI became infected with *Streptococcus viridans*; subject

XIII with *D. pneumoniae*, type viii; subject XVIII with *Staphylococcus aureus* (hemolytic); and subject XXIV with *D. pneumoniae*, type vi. In making the transfer from each of these to the subsequent subject, scrapings were made and transferred between 10:00 a.m. and 12:00 m. At 4:00 p.m. of the same day and at 8:00 a.m. of the following day the recipient had one drop of 1-percent aqueous solution of silver nitrate instilled into the conjunctival sac of each eye. A mild chemical conjunctivitis of approximately 30 hours' duration, resulted in each of these cases, but subsequent cultures failed to reveal pathogenic bacteria. In these cases cultures were made daily for 10 days and at 2- to 4-day intervals thereafter. The course of the disease apparently was unaffected in these recipients, for the incubation period was 7 days in 3 and 8 days in 1 case. The onset was abrupt and the acute phase was considered severe in all four.

By mistake, recipient XXVI was inoculated before his preinoculation cultures had been incubated 48 hours. The conjunctiva appeared healthy and no growth was observed on the cultures after 24-hours' incubation. The inoculation was made but on the following morning the culture from each eye (after 48-hours' incubation) revealed several small umbilicated colonies surrounded by narrow zones of alpha (green) hemolysis. These bacteria were subsequently identified as *D. pneumoniae*, type xiv. The positive cultures were discovered approximately 18 hours after the inoculation and immediately treatment with 0.5-percent silver-nitrate ointment was instituted. The ointment was instilled three times a day for three days. Cultures made the morning after treatment was discontinued and throughout the remainder of the course failed to grow pathogenic bacteria. The incubation period in this instance was 15 days, but the

onset was abrupt and manifestations rapidly became severe.

Inclusion bodies were found in Giemsa-stained scrapings prepared from the lower fornix of each case at the onset of disease manifestations, and the relative number of epithelial cells containing inclusion bodies increased for several days. In the five control cases inclusion bodies were demonstrable throughout the acute phase and well into the chronic phase. In 4 cases inclusion bodies were found for 9 weeks after the onset and for 10 weeks in the fifth case (table 6). Scrapings from various locations on the conjunctiva during the acute phase revealed that epithelial cells containing inclusion bodies were more numerous in the region of maximum pathology. The greatest number of inclusion-body-containing cells was always found in the lower fornix; however, inclusion bodies were found in numerous epithelial cells from the upper fornix and upper lid in the more severe cases.

Inflammatory cells found in the scrapings were similar to those observed in inclusion blennorrhea of the newborn: numerous polymorphonuclear leucocytes during the early part of the acute phase; moderate numbers of small lymphocytes throughout all phases; occasional plasma cells; and a few large mononuclear cells which exhibited macrophagic activity. The phagocytic large mononuclear cells (Léber) were never numerous but usually 6 to 10 cells were found in the average scraping made 4 to 6 days after the onset of symptoms.

*Discussion.* The transfer of conjunctival scrapings from a case of inclusion blennorrhea of the newborn (acute phase) to the normal conjunctiva of a six-year-old subject resulted in the development of signs and symptoms identical with those described for swimming-bath conjunctivitis. This result was observed

previously by Gebb,<sup>17</sup> Hartman,<sup>20</sup> Kalt,<sup>21</sup> and Thygeson,<sup>11</sup> and led them to conclude that this was the adult form of inclusion blennorrhea. In the remaining 39 subjects of the direct conjunctival-passage experiments, the general manifestations were similar to or identical with those of the first. There were variations in severity of signs and symptoms (table 5) but the variations were irregular and not progressive. Furthermore, the variations in severity were no more extensive than those observed in cases of inclusion blennorrhea of the newborn as described in part I of this report. Corneal complications were limited to transitory, fine, superficial, epithelial disturbances which were present only during the period of maximal manifestations in the acute phase and were no worse than those observed in cases of inclusion blennorrhea of the newborn (part I). Neither infiltrates nor pannus formation was found upon examination with slitlamp and biomicroscope in any case of the series. Therefore, it may be concluded that, in this series of 40 consecutive conjunctival passages, the etiologic agent of inclusion blennorrhea did not change its disease-producing characteristics nor progressively alter its virulence.

Bacteriologic studies in this group of consecutive conjunctival inoculations failed to reveal the presence of pathogenic bacteria except in four cases. Cultures from subjects number XI, XIII, XVIII, and XXIV revealed bacteria commonly classified as conjunctival pathogens, but the organisms were different in each case; that is, *Streptococcus viridans*, *D. pneumoniae*, type viii, *Staphylococcus aureus*, and *D. pneumoniae*, type vi. This inconsistency in species of pathogenic bacteria and the irregularity of their appearance in the series led to the conclusion that they were secondary invaders, without etiologic significance. This conclusion was

substantiated by the results of passage inoculations from these cases. As previously described, the inoculation was made to the subsequent subject from each of these cases while bacteria were present and demonstrable in conjunctival scrapings. However, each recipient subject (numbers XII, XIV, XIX, and XXV) had one drop of 1-percent aqueous solution of silver nitrate instilled into each conjunctival sac 6 hours and again 20 hours after the inoculation. Subsequent cultures from these cases did not reveal pathogenic bacteria, but the onset and manifestations of inclusion blennorrhea were unaffected (table 5). Furthermore, this furnished experimental proof for the clinical deduction that Credé prophylaxis did not prevent the development of inclusion blennorrhea. Additional proof of the same point was furnished by the experience with subject number XXVI who was treated with 0.5-percent silver-nitrate ointment three times a day for three days after the inoculation without preventing the development of inclusion blennorrhea.

Leber cells were found in scrapings from each case of this series. Although this observation has not been stressed by previous observers, it was not interpreted as signifying a change in the character of the etiologic agent, because approximately equivalent numbers of these cells were found in scrapings from cases of inclusion blennorrhea of the newborn (part I).

The essential difference between inclusion blennorrhea of the newborn and the adult, as exemplified by these two series of cases (part I and part II), was the appearance of follicles early in the acute phase of the adult. They appeared 60 to 90 days after the onset of symptoms in the newborn. This difference, probably, is anatomic rather than pathologic, since the adenoid layer of the substantia propria of the conjunctiva "is absent in the newborn and only commences to develop 2 to

TABLE 7  
COMPARISON OF AVERAGE MANIFESTATIONS  
OF INCLUSION BLENNORRHEA

	Newborn	Adult
Incubation period	8 d.	8 d.
Developmental phase	few hrs. to 6 d.	few hrs. to 6 d.
Acute phase	21 d.	21 d.
Duration of:		
Edema	21	21
Pseudomembranes	3-7	2-7
Preauricular adenopathy	32	23
Conjunctival infiltration	59	39
Discharge	60	44
Inclusion bodies	66	64
Appearance of follicles	2-3 mo.*	3-5 d.*
Duration of follicles	5.5 mo.	5 mo.
Total duration of signs	7 mo.	5 mo.

\* From onset of signs.

3 months after birth."<sup>22</sup> In other respects the two groups of cases were similar (table 7).

*Conclusions.* 1. In this series of 40 consecutive conjunctival passages the etiologic agent of inclusion blennorrhea did not change its disease-producing characteristics nor progressively alter its virulence.

2. The signs and symptoms produced in each subject, as a result of the inoculation, were those of swimming-bath conjunctivitis or adult type of inclusion blennorrhea.

3. Further proof of the nonbacterial nature of the infectious agent was furnished by this series of cases.

4. Experimental proof of the ineffectiveness of silver salts in the prevention of inclusion blennorrhea was observed in five cases.

5. Large mononuclear phagocytes (Leber cells) were observed in the scrapings from all cases.

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# THE ETIOLOGY AND TREATMENT OF TOBACCO-ALCOHOL AMBLYOPIA\*

## Part II

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Case 9. L. W., aged 58 years, was referred to the Neurological Institute in August, 1937, by his oculist because of "signs of a pituitary lesion." He stated that for the previous nine months he had noticed an increasing blur in his vision. At first he thought this was due to

cated in his visual field. It was an area in each field just temporal to the point of fixation; these bitemporal field defects which actually were typical centrocecal scotomas (fig. 5), probably caused his oculist to think he had a pituitary lesion. The neurologic examination

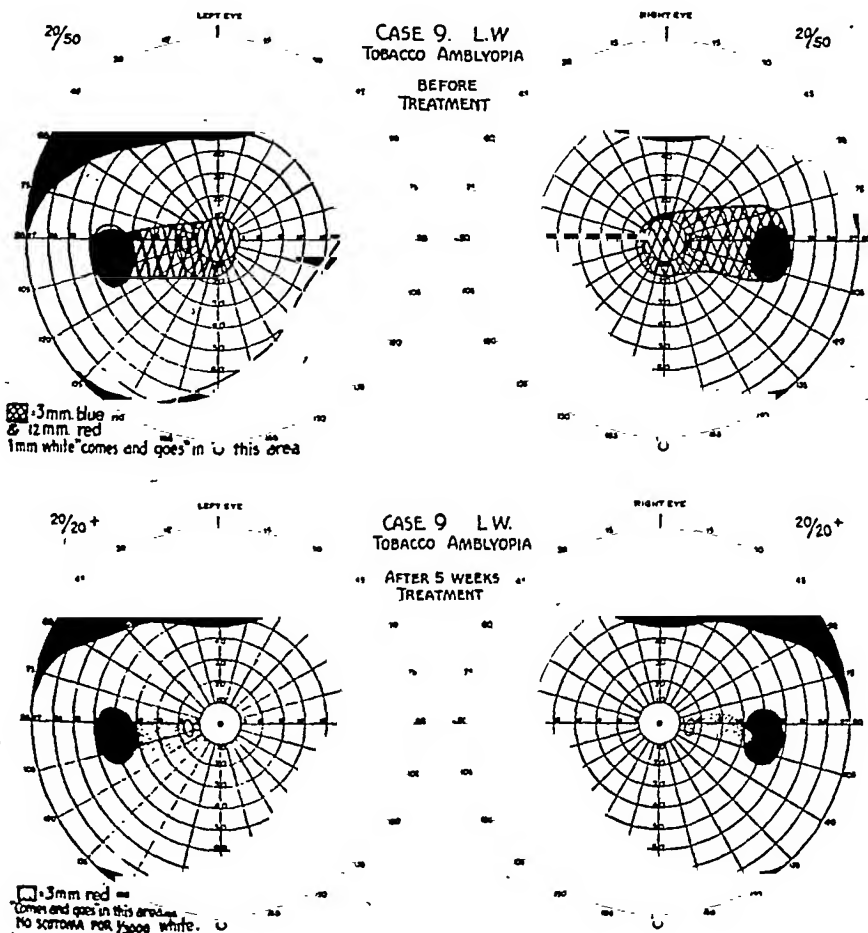


Fig. 5 (Carroll). Case 9. Fields of L. W.

dirt on his glasses and he wiped them off repeatedly but in vain. Six months before admission he consulted an optometrist who sold him new lenses which did help his condition. The patient was a very intelligent person and he had figured out just where the "blur" was lo-

was entirely negative except for the eyes, and the patient was referred to me.

At the time of onset of the amblyopia the patient was smoking three cigars daily and one package of cigarettes in three days. Thus he was not a heavy smoker and he consumed no alcohol. After being questioned on this point day after day he finally admitted that before the last war he bought a quart of liquor, but

\* Part I appeared in the preceding issue of this Journal.

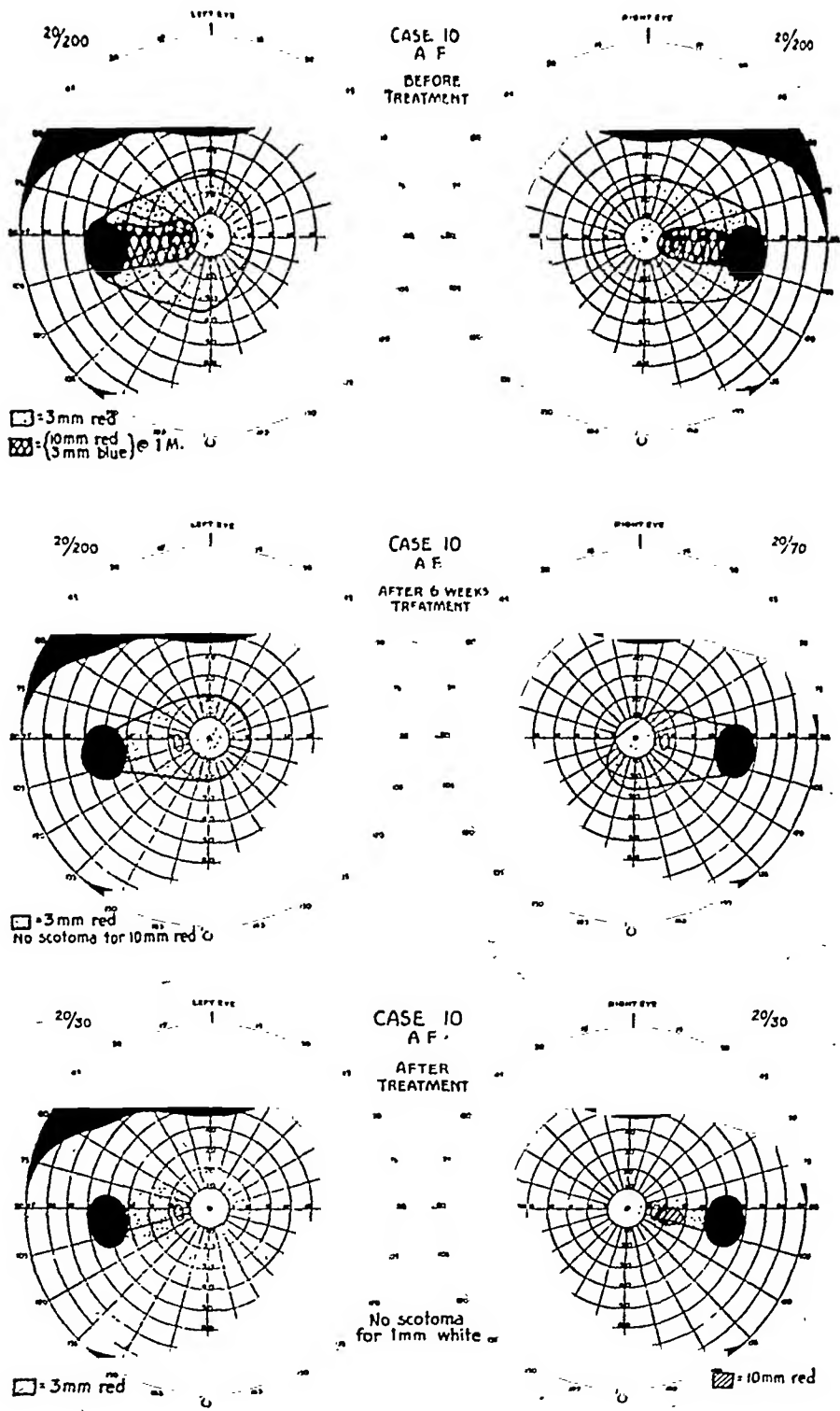


Fig. 6. (Carroll). Case 10. Fields of A. F.

stated that he still had a pint of it left, 20 years later. He is considered a teetotaler. The patient had lost 30 pounds during the last year. He was working for the W.P.A. and his financial status was such that he was economizing on food.

The dietary history indicated that his intake of vitamin B<sub>1</sub> was borderline in adequacy, not definitely deficient. Visual acuity in each eye was 20/50. Visual fields showed centrocecal scotomas (fig. 5).

The retinal vessels showed moderate sclerosis, and numerous drusen were present in the macula. Gastric analysis revealed absence of hydrochloric acid even after the administration of histamine. The patient was placed on a high-vitamin diet supplemented by brewers' yeast in doses of 2 teaspoonfuls four times daily, vegex in doses of 1 teaspoonful three times daily, liver extract in doses of 5 c.c. three times weekly, and dilute hydrochloric acid in

after his first examination by me he returned for a check-up. He had continued to smoke the usual amount; his diet was much better, and he was taking 3 tablespoonfuls of yeast weekly. Vision was 20/20, O.U., and there was no evidence of any scotomas.

On June 23, 1942, almost five years after his first examination, he again returned for a check-up. Vision was O.U. 20/15, and no scotoma could be outlined. He had never decreased his

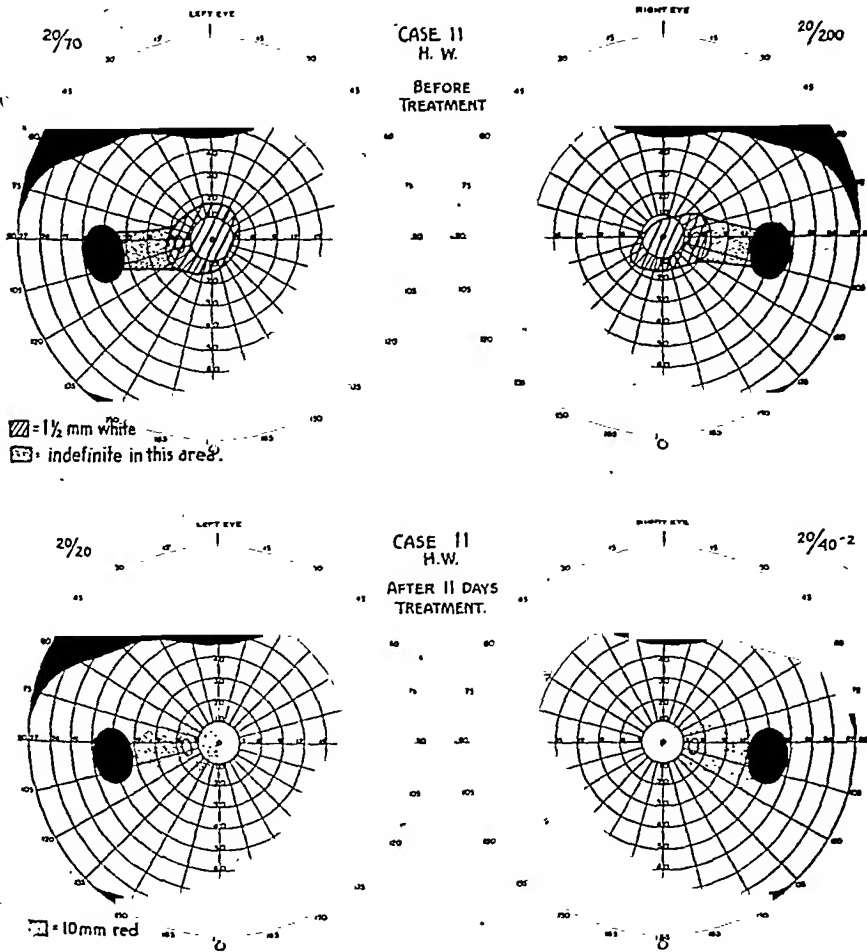


Fig. 7 (Carroll). Case 11. Fields of H. W.

doses of 15 drops before meals. He smoked one to two cigars a day more than while developing the amblyopia—that is, four to five cigars daily—and consumed at least as many cigarettes as previously.

He remained in the hospital five weeks on this regime. At no time was the use of tobacco decreased. The vision increased from 20/50, O.U., to 20/20+, O.U., during this time, and the fields improved as shown in figure 5. The residual scotoma gradually decreased in size until it could not be plotted. Twenty months

consumption of tobacco. His diet was adequate in all respects.

*Case 10.* A. F., aged 48 years, was admitted to the Eye Institute on February 9, 1938. He stated that his vision had been gradually failing for six months and that he had been unable to read for three months. He smoked one package of cigarettes and one to two cigars daily, and drank four to five highballs daily. Vision corrected was O.D. 20/200 and O.S. 20/200, and the visual fields showed typical scotomas (fig. 6). The discs appeared to be normal. No free

hydrochloric acid was present, according to the gastric analysis, even after the administration of histamine. The patient received one pint of liquor daily and a diet low in all vitamins. This diet was calculated to be just adequate, or perhaps slightly inadequate, for vitamin content. However, he received 33 mg. vitamin B by mouth daily, and 10 mg. intravenously daily for

nine months after his discharge from the hospital his vision remained at 20/40.

He returned for a check-up four years later. The vision was 20/30, O.U. He claimed that he had decreased his intake of alcohol but was using the same amount of tobacco.

Case 11. H. W., aged 30 years, was first refracted in the Eye Department of the Vander-

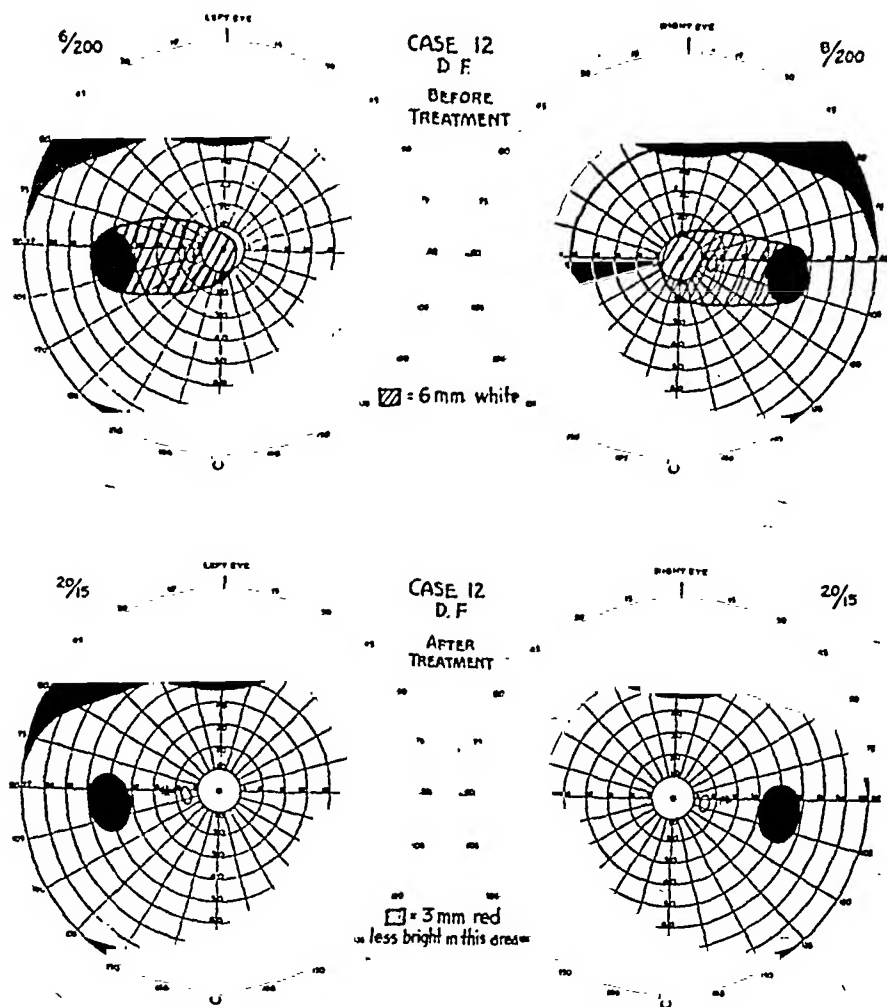


Fig. 8 (Carroll). Case 12. Fields of D.F.

three weeks, and then 10 mg. by mouth daily. During the six weeks of hospitalization the visual fields improved as shown in figure 6. The visual acuity in the left eye did not show improvement, however, until four months after onset of treatment, and 20/40-vision was not obtained until three months later.

The patient was instructed in obtaining a well-balanced diet at home, but was not cooperative. He continued to drink and smoke as much as ever, and on his visits to the clinic usually smelled strongly of alcohol. He also continued to take 3 to 6 mg. of vitamin B<sub>1</sub>, and

bilt Clinic on March 27, 1935. Vision with correction was 20/20+, O.U. He returned on June 17, 1938, and the vision could not be corrected to better than O.D. 20/200, O.S. 20/70. The same high myopic astigmatism which previously had been corrected to 20/20 was present, and there was nothing in the fundi to explain the reduced vision. Fields were typical of tobacco-alcohol amblyopia (fig. 7). Questioning revealed that he smoked 30 cigarettes daily and drank 4 to 5 highballs daily. He was on home relief or W.P.A. and his diet seemed inadequate. He was admitted to the hospital, placed on a diet

low in all vitamins, given one pint of liquor daily and 15 mg. of synthetic vitamin B<sub>1</sub>. In 11 days the vision with the same correction was O.D. 20/40—2, O.S. 20/20, and the patient said there had been "remarkable improvement." The spaghetti menu which was used to obtain the deficient diet was so monotonous that the patient ate very little and lost 11 pounds in two

later that the day after discharge from the hospital he developed a dryness of the hands and pains in the arms and calves of the legs which lasted four to five days. He was observed over a further period of three months in the Clinic, and the final vision was 20/20, O.U.

In July, 1942, the vision was still 20/20, O.U.  
Case 12. D. F., a 45-year-old truck driver,

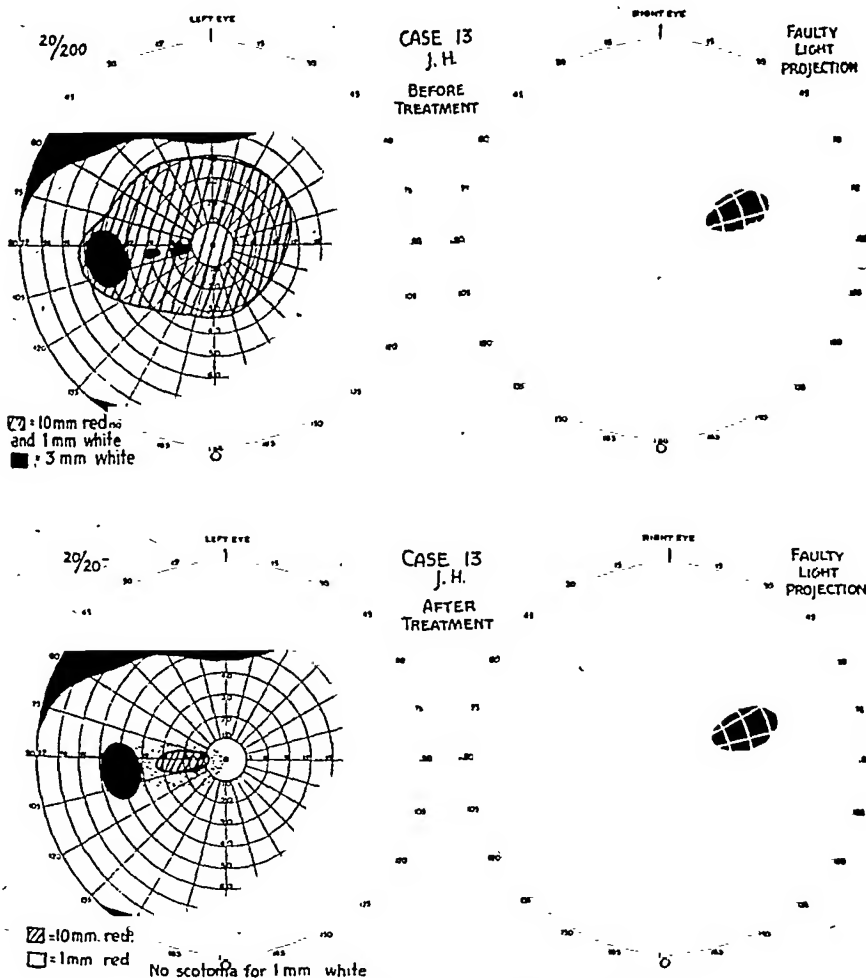


Fig. 9 (Carroll). Case 13. Fields of J. H.

weeks, but he took his 15 mg. of vitamin B<sub>1</sub> daily. Although there was a striking improvement in the visual acuity, the fields in 11 days showed fairly dense scotomas (scotoma for 10 mm.-red test object at 1 meter but no scotoma for 1-mm. white test object at the same distance—a disproportion which is a favorable prognostic sign). He remained in the hospital five weeks on a diet deficient or borderline in all vitamins except synthetic B<sub>1</sub>. On this regime he lost 15 pounds, but the vision on discharge had increased to O.D. 20/30—, O.S. 20/20, and the scotomas were much smaller. He stated

was admitted to the Eye Institute on January 23, 1939. He stated that two years previously he had weighed 215 pounds. At that time it was discovered that he had diabetes, and he went on a diet which resulted in his losing 72 pounds. For the past two years he had entirely abstained from the use of alcohol, but he was a moderately heavy smoker, consuming a package of tobacco every 1½ days and three cigars daily. Four months previous to his admission he noticed that his vision was decreasing and this continued to get worse. He had noticed some "neuritis" in his knees and right shoulder.

Vision was O.D. 20/200, O.S. 10/200, and the fields were characteristic of tobacco amblyopia. Ocular examination was otherwise negative. During the 13 days he remained in the hospital and for a total of three months he showed no improvement. He continued on the same diet, the same amount of tobacco, and 10 mg. of vitamin B<sub>1</sub> daily. Vision decreased to O.D. 8/200, O.S. 6/200 one month after discharge from the hospital. The tobacco was then stopped entirely.

No improvement was seen and in another month he began to take brewers' yeast, 6 tablespoonfuls daily in milk. He put on 10 pounds in weight in a month and the vision began to

improve, owing to an injury with a stone, and that the eye had been divergent for many years. The vision in the left eye had become increasingly blurred during the preceding five months. On questioning he said that about the time of onset of blurred vision he was having many financial worries and had lost 30 pounds in weight. To indicate his weight loss he pulled out his vest which obviously was now too large for him. He smoked "most of the time"—eight cigars daily as well as occasional cigarettes and a pipe. He also drank about one-half to one pint of liquor daily. Vision was O.D. light perception, O.S. 20/200—. The right eye was divergent and an old traumatic chorioretinitis accounted for

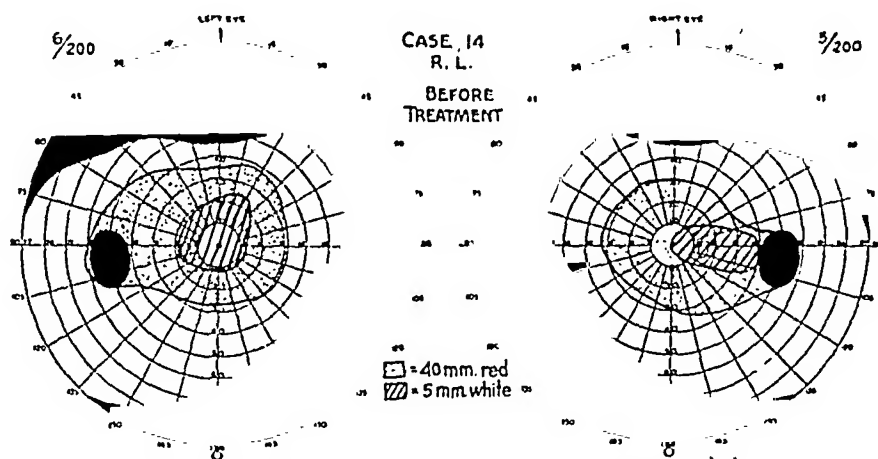


Fig. 10 (Carroll). Case 14. Fields of R. L.

improve. In six months the vision was O.D. 20/30—, O.S. 20/200. He had stopped smoking for two months. At this point he resumed smoking his usual amount or somewhat more than usual but continued the yeast in large amounts (6 tablespoonfuls daily). In seven months vision was O.D. 20/20+, O.S. 20/30—. In 11 months the vision was O.U. 20/15. He was smoking six cheap (three for 10 cents) cigars daily and one package of tobacco every 1½ days and taking 4 tablespoonfuls of yeast daily. In one year there was no change, and the field was as shown in figure 8. He continued to take 1 tablespoonful of yeast daily.

On June 23, 1942, 3½ years after hospitalization, vision was O.D. 20/15, O.S. 20/20—. In the area between the blindspot and the point of fixation in each eye a 1-mm. red test object at 1 meter seemed less bright than it did nasally but no scotoma could be outlined. He was a heavy smoker and had not decreased his consumption of tobacco. He still uses no alcohol. He was on a well-balanced diet for his diabetes.

**Case 13.** J. H., aged 50 years, came to Vanderbilt Clinic on October 1, 1940. He stated that the vision in the right eye was lost in child-

hood, owing to an injury with a stone, and that the eye had been divergent for many years. The vision in the left eye had become increasingly blurred during the preceding five months. On questioning he said that about the time of onset of blurred vision he was having many financial worries and had lost 30 pounds in weight. To indicate his weight loss he pulled out his vest which obviously was now too large for him. He smoked "most of the time"—eight cigars daily as well as occasional cigarettes and a pipe. He also drank about one-half to one pint of liquor daily. Vision was O.D. light perception, O.S. 20/200—. The right eye was divergent and an old traumatic chorioretinitis accounted for

**Case 14.** R. L., a 43-year-old Negro, was referred by his oculist because of "optic neuritis with retinal hemorrhages." The patient stated that his vision had been getting worse for two



months. He admitted drinking about one to two pints of "King Kong" (a bootleg whisky sold in Harlem) daily and smoking two packages of tobacco weekly. His diet for the past year seemed to have been inadequate. Vision was O.D. 5/200, O.S. 6/200. The disc of the right eye appeared hyperemic, and a small fresh linear hemorrhage was present near the inferior

his vision was slightly better (20/200, O.U.) and he was allowed to go home. In another month the vision was 20/70, O.U. In another month, after taking nicotinic acid in doses of 200 mg. daily, as well as 10 mg. of vitamin B<sub>1</sub> daily, vision was 20/20, O.U. The next month, after taking Betaplexin in doses of 2 tablespoonfuls three times daily, the vision was

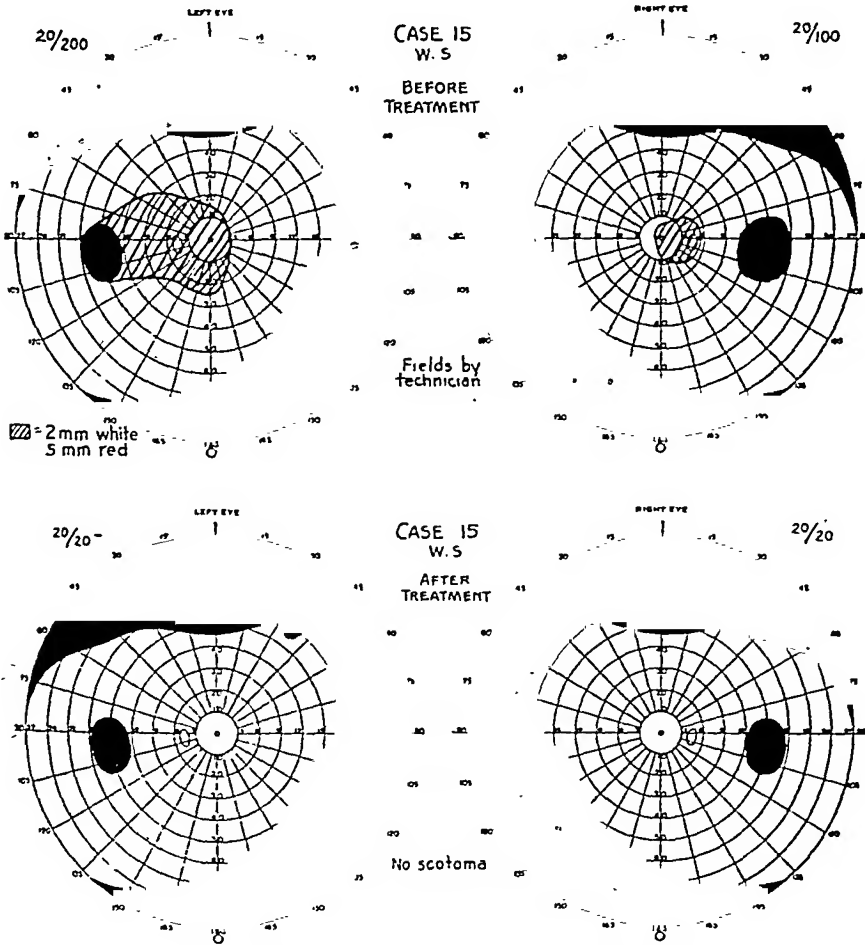


Fig. 11 (Carroll). Case 15. Fields of W. S.

temporal vein. The left disc also looked hyperemic, and a striate hemorrhage was located 1 disc diameter from the papilla along the superior temporal artery. The field is shown in figure 10. The patient was admitted to the Eye Institute on January 15, 1940. The patient's liver was palpable 2 finger breadths below the costal margin. The skin on the legs showed a roughness and desquamation which the medical consultant thought due to vitamin-B-complex deficiency disease.

In the hospital he received one pint of liquor and his usual amount of tobacco daily. His diet was inadequate in all vitamins, but he received 40 mg. of vitamin B<sub>1</sub> daily. In 26 days

20/20—, O.U., and it remained at that level for the next six months.

*Case 15.* W. S., aged 36 years, another Negro from Harlem, also had been drinking about one quart of "King Kong," a cheap bootleg whisky, daily. He was referred by Dr. Charles Marrin, who had made a diagnosis of tobacco-alcohol amblyopia. On January 22, 1940, the patient was admitted to the Eye Institute. The vision was O.D. 20/100, O.S. 20/200. The discs appeared negative for pathologic change and the fields were as shown in figure 11. The patient stated that his vision had become blurred six months previously and had gradually become worse. Physical examination showed an enlarged liver.

He was allowed to drink one pint of liquor daily and smoke as many cigarettes as he had previously taken. The diet was made inadequate in all vitamins, but he received 40 mg. of vitamin B<sub>1</sub> daily. After three weeks on this regime his vision improved to O.D. 20/20—, O.S. 20/50—, and he was discharged with instructions to take 10 mg. of vitamin B<sub>1</sub> daily. He returned to the clinic in a month saying that his vision had become much worse. Vision was recorded as O.D. 20/50, O.S. 20/200, and the fields recorded by a technician showed a marked contraction, especially the field of the left eye. The patient

ment mottling in the macula of each eye, and a tentative diagnosis of macular degeneration had been proposed. Vision was O.U. 4/200, the discs showed moderate (No. 2 on a basis of No. 1 to 4) temporal pallor, and there was a slight pigment stippling in each macula. The fields (fig. 12) quickly indicated the correct diagnosis. The patient was admitted to the Eye Institute on May 6, 1940, and while there received daily, vitamin-B<sub>1</sub> doses of 15 mg., 6 capsules of vitamin-B complex (Ledërle), 200 mg. of nicotinic acid, and 12 oz. of liquor. He was discharged in 18 days, slightly improved. In one month vision was 20/200, O.U.; in five

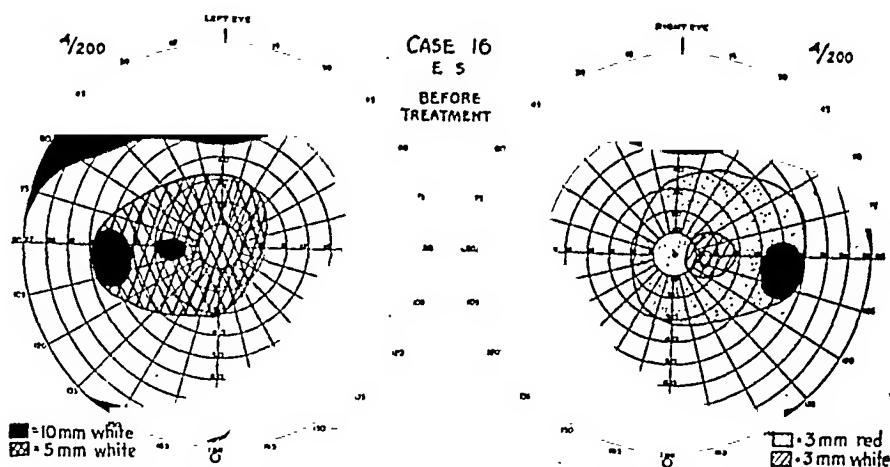


Fig. 12 (Carroll). Case 16. Fields of E. S.

was given nicotinic acid in doses of 100 mg. daily, as well as vitamin B<sub>1</sub>, and in two weeks his vision was again O.D. 20/30, O.S. 20/50. It was not clear exactly why he temporarily developed a contracted field and loss of vision but it was considered possibly due to a deficiency in the other components of vitamin B. Whether, however, the nicotinic acid caused the improvement cannot, of course, be definitely stated. He was given brewers' yeast in doses of 6 tablespoonfuls daily, and in five weeks the vision was O.D. 20/20, O.S. 20/30+. He had continued to consume one pint of liquor every day. On February 19, 1942, when last seen, his vision was O.D. 20/20, O.S. 20/20—. No scotoma could be found. His breath had a heavy alcoholic odor, but he stated he was drinking only half as much as formerly. He was taking small amounts of yeast.

**Case 16:** E. S., a 32-year-old Negro, said that his vision had failed in one week four months previously and that he had been unable to read since that time. He drank about one pint of liquor daily and smoked one package of cigarettes. The patient complained of having no appetite and admitted that he had lost 10 pounds in weight recently. One oculist had noticed pig-

ment mottling in the macula of each eye, and a tentative diagnosis of macular degeneration had been proposed. Vision was O.U. 4/200, the discs showed moderate (No. 2 on a basis of No. 1 to 4) temporal pallor, and there was a slight pigment stippling in each macula. The fields (fig. 12) quickly indicated the correct diagnosis. The patient was admitted to the Eye Institute on May 6, 1940, and while there received daily, vitamin-B<sub>1</sub> doses of 15 mg., 6 capsules of vitamin-B complex (Ledërle), 200 mg. of nicotinic acid, and 12 oz. of liquor. He was discharged in 18 days, slightly improved. In one month vision was 20/200, O.U.; in five

months, 20/70, O.U. He continued his smoking and drinking. His wife stated that he took his vitamin-B complex or brewers' yeast daily and that he was "always hungry." Previously he had had a "very poor appetite."

**Case 17:** A. Mc., aged 44 years, was a volunteer airplane observer. He stated that it was very cold in winter to stand on the roof of his post looking for aircraft. Therefore he drank about one pint of gin or rye daily as well as a "few beers." He smoked almost two packages of cigarettes daily. His appetite was "poor." Finally he consulted Dr. Ramon Castroviejo, who made the diagnosis and allowed me to treat him. The patient said that his vision had been decreasing for five months. The vision on December 30, 1941, was O.D. 20/40, O.S. 20/40—. The discs appeared to be normal and the fields were as shown in figure 13. The patient was given a pint of Betaplexin and advised to take 6 teaspoonfuls daily. In two weeks he returned to the office very much worse, although he had taken the Betaplexin faithfully. The vision had decreased from 20/40—, O.U., to O.D. 10/200, O.S. 20/100. He was hospitalized at once and put on the following regime daily: Betaplexin in doses of 12 c.c. three times daily, thiamin in

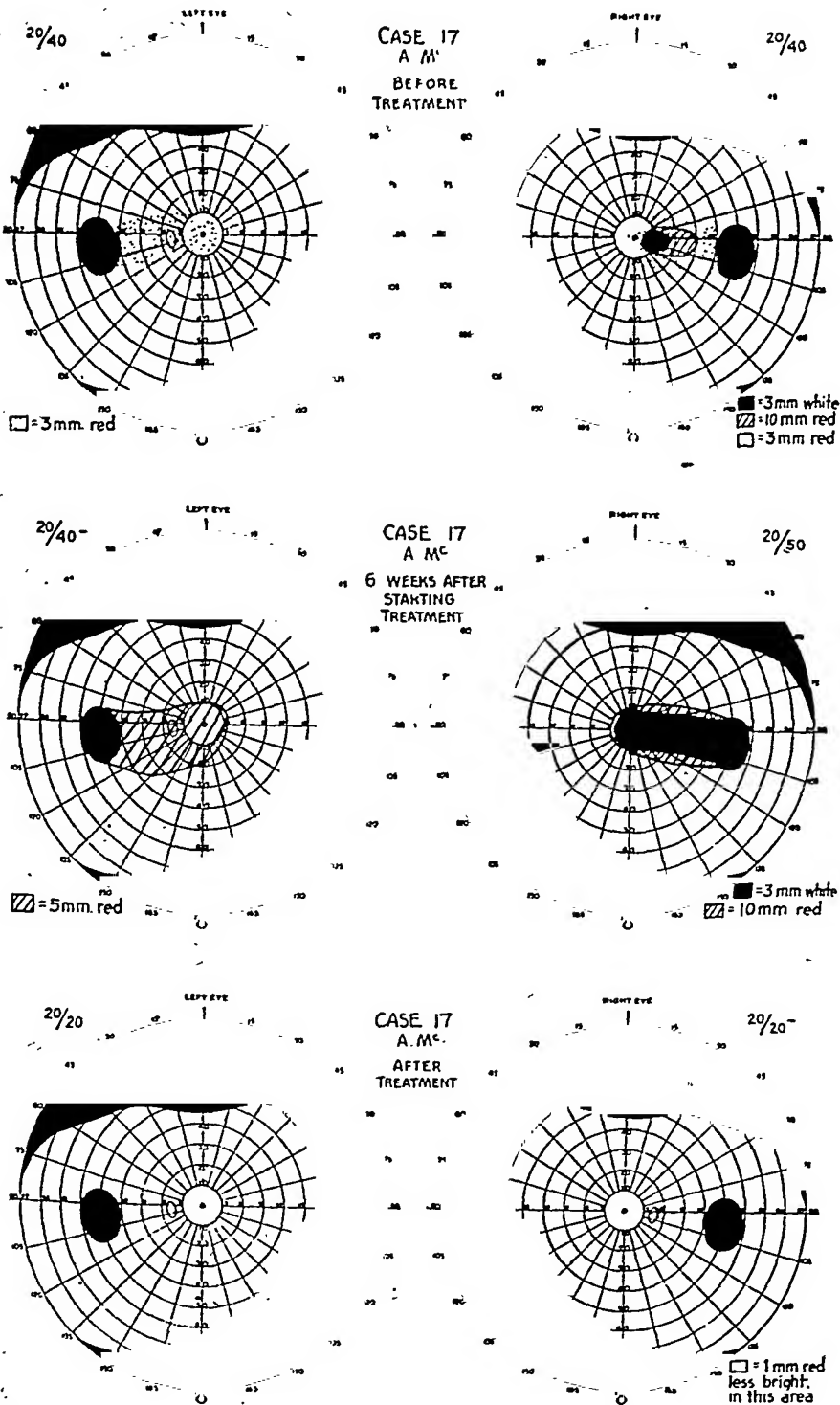


Fig. 13 (Carroll). Case 17. Fields of A. Mc.

doses of 20 mg. intravenously for one week and then 20 mg. by mouth, one pint of liquor, and his usual number of cigarettes. In one month in the hospital on this regime there had been a considerable improvement, vision O.D. 20/50,

O.S. 20/40—, but the fields were still worse than when the patient had first been seen in the office (fig. 13). His weight increased from 132 to 148 pounds in this period. Two weeks later vision was O.U. 20/20—. His fields have im-

proved considerably (fig. 13). He admitted taking his customary amount of liquor and tobacco again. He also took 24 c.c. (2 teaspoonfuls, three times daily) of Betaplexin and 10 mg. of vitamin B<sub>1</sub> daily.

On June 25, 1942, vision was O.D. 20/20—, O.S. 20/20; no scotoma could be plotted in either eye. He had been "celebrating" for the past month and was taking over a quart of whisky daily, despite all advice to the contrary.

fingers at 2 feet, O.S. counts fingers at 4 feet. O.U. anterior chamber shallow; vitreous opacities, granular appearance of macula, tension normal, fields as shown in figure 14. The patient said he had been drinking more than usual since his oculist had informed him that he had macular degeneration and that it was unlikely that his central vision would ever improve. Dr. Wheeler gave a favorable prognosis. The patient was advised to discontinue the use of

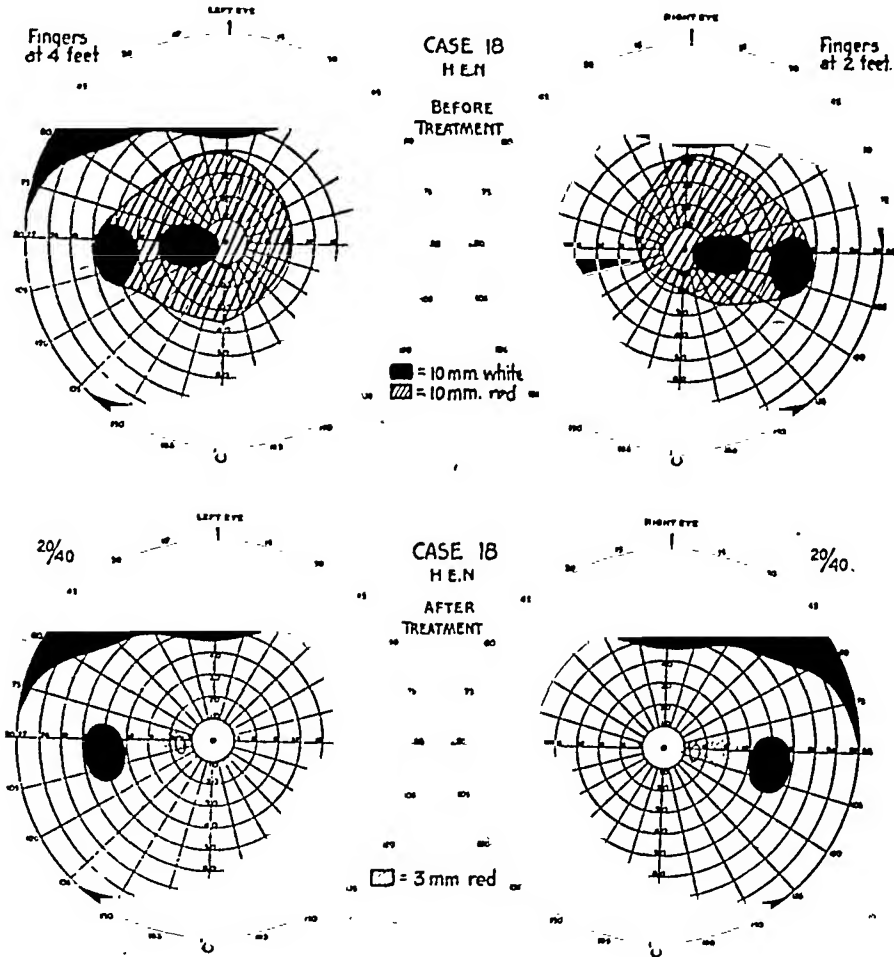


Fig. 14 (Carroll). Case 18. Fields of H. E. N.

He also took 10 mg. of thiamin chloride every day.

*Case 18.* H. E. N., a 73-year-old newspaper editor, consulted the late Dr. John M. Wheeler, on April 17, 1936. He stated that his vision had become increasingly blurred for the past five weeks. His oculist had made a diagnosis of macular degeneration. The patient smoked six cigars and drank three bottles of beer and a few highballs daily. Since he had been accustomed to taking as much as this for several years, at least, his oculist felt that tobacco and alcohol could not be important in the etiology of his poor vision. Vision was O.D. counts

tobacco and alcohol but he did not. However, he did take all the medications I ordered, which included daily, brewers' yeast 4 tablespoonfuls, Vegex 2 tablespoonfuls, and wheat germ 4 tablespoonfuls. In one month vision was O.D. 20/200 O.S. 20/70; after two months O.D. 20/100, O.S. 20/40; after three months O.D. 20/50—, O.S. 20/20—; after five months O.D. 20/40+, O.S. 20/20—. After one year vision was O.D. 20/30, O.S. 20/30; after six years, O.D. 20/40, O.S. 20/40. This patient is now 79 years of age. Against advice he at first continued his usual consumption of alcohol and tobacco. At present he is using approximately

the same amount. Lens and vitreous opacities are now sufficient to explain the 20/40 vision, O.U. He has been seen at six-month intervals for the past five years. He still takes 1 to 2 tablespoonfuls of brewers' yeast or 2 to 4 capsules of vitamin-B complex daily. Present fields are shown in figure 14.

**Case 19.** A. B. was first seen at the Vanderbilt Clinic on November 19, 1940. He said that his vision had been blurred for several months

papilla. The patient drank some wine, beer, and probably one-half pint of whisky daily, and smoked one package of cigarettes daily. His appetite was poor. He was admitted to the Eye Institute on December 9, 1940, and was given a low vitamin diet, 40 mg. of vitamin B, nine capsules of vitamin-B complex, one pint of liquor, and an unlimited number of cigarettes daily. The liver was found to be enlarged. The prothrombin time was increased, but the results

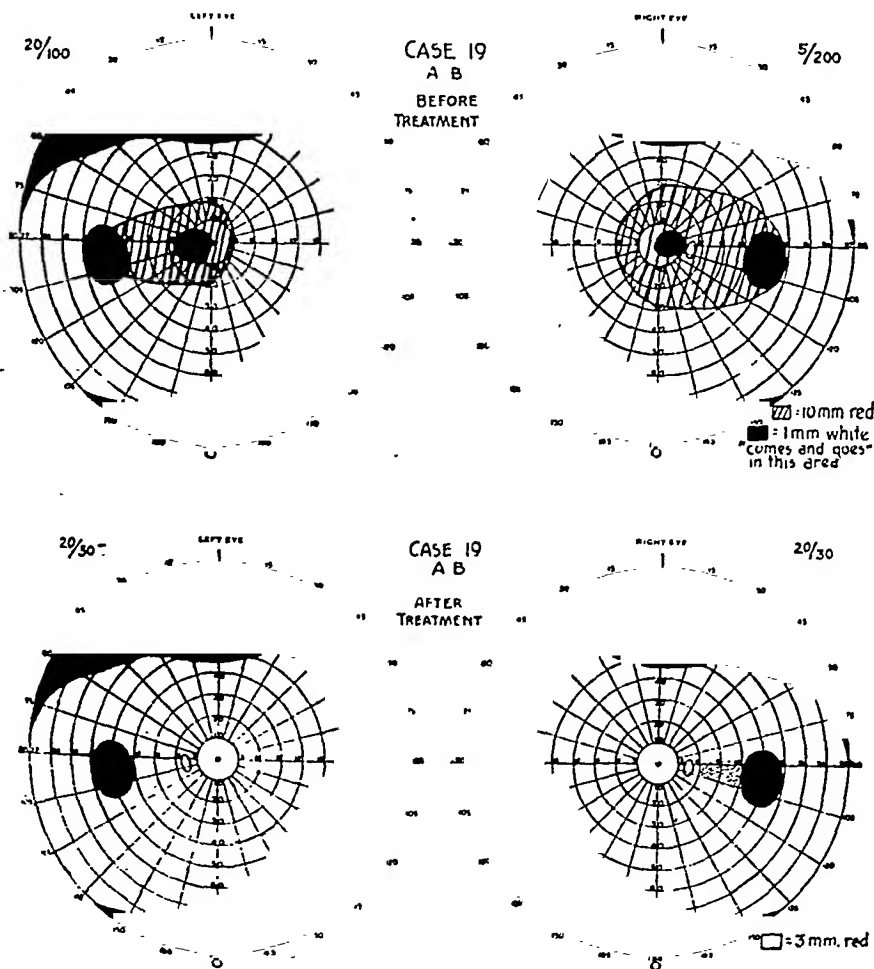


Fig. 15 (Carroll). Case 19. Fields of A. B.

and that he had not been able to read for the past four weeks. The vision was O.D. 5/200, O.S. 20/100, and the fields showed centrocecal scotoma (fig. 15). He was advised to take 12 brewers' yeast tablets daily. Two weeks later I first examined the patient. The vision was unimproved. In each macular area drusen were present as well as some pigment stippling. The discs appeared to be normal but in the fundus of the left eye there was a large striate retinal hemorrhage close to the inferior temporal vessels—1½ disc diameters from the

of capillary fragility tests were normal. The retinal hemorrhage in the left eye became absorbed in one week. Dr. Ferobee of the Neurological Institute found 360 micrograms of vitamin B<sub>1</sub> in the urine following the oral administration of 2 mg. of thiamin chloride, and stated that no vitamin-B<sub>1</sub> desaturation was present, but this test was made three weeks after the beginning of treatment. The patient was discharged from the hospital after 25 days on the aforementioned regime, which included one pint of liquor daily and his usual supply of to-

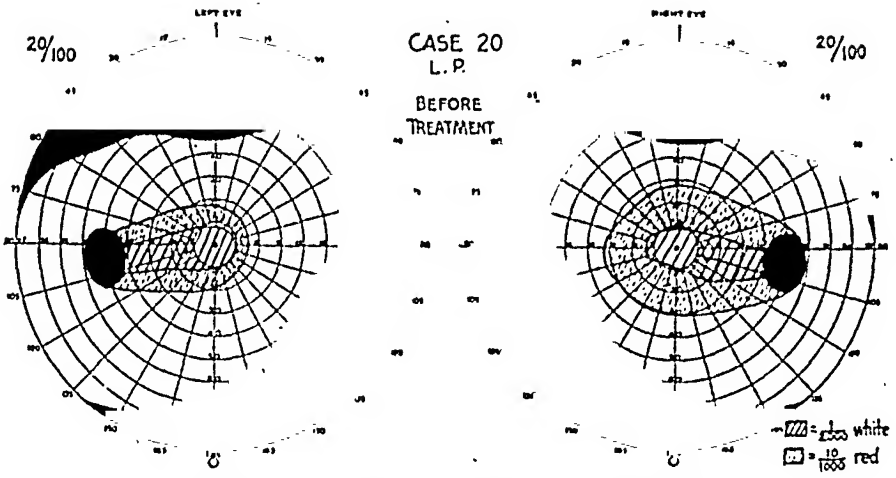


Fig. 16 (Carroll). Case 20. Fields of L. P.

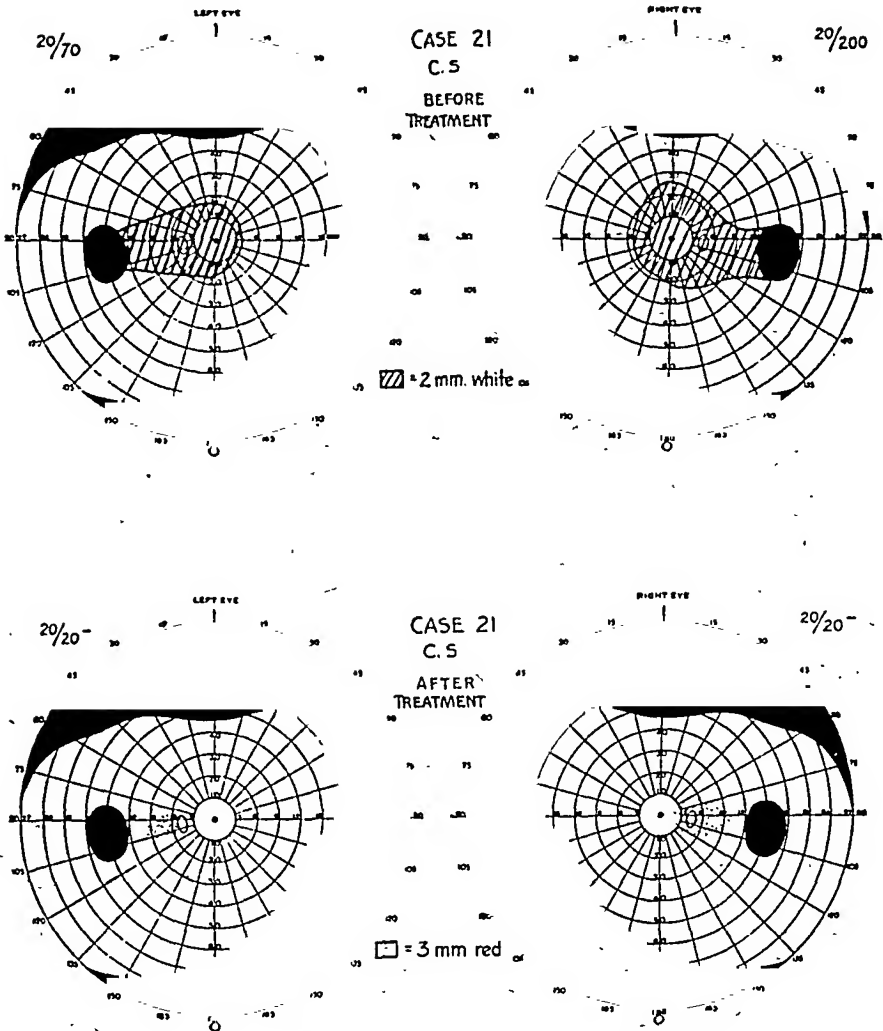


Fig. 17 (Carroll). Case 21. Fields of C. S.

bacco. His vision improved from O.D. 5/200, O.S. 20/100 to O.D. 20/80+, O.S. 20/30—.

On June 30, 1942, 18 months later, the vision was O.D. 20/30—, O.S. 20/30, and the fields were as shown. He was smoking the same amount of tobacco but claimed he had somewhat decreased his consumption of alcohol.

Case 20. L. P., aged 42 years, came to Vanderbilt Clinic on February 29, 1940. His vision had been failing for eight months. He drank

beer drinking during this period. Yeast, 4 table-spoonfuls daily, was substituted for the aforementioned therapy since the cost was less. In the next six months the vision gradually improved to 20/30—, O.U., and at his last visit, in February, 1942, two years after the first examination, the vision was 20/30, O.U. Visual fields were not recorded at the last visit but the discs appeared to be normal. He was drinking and smoking the same amount that he had while

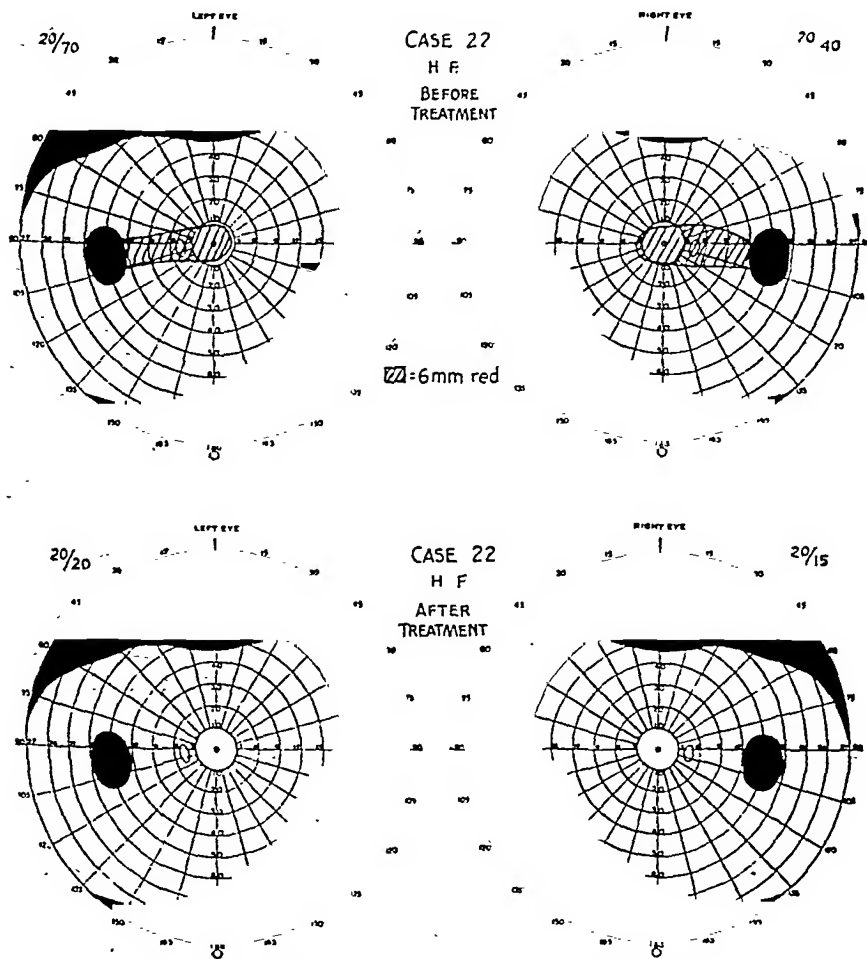


Fig. 18 (Carroll). Case 22. Fields of H. F.

about two quarts of beer daily and smoked a package of cigar clippings every other day. His teeth were in very poor condition, and he had not been eating well. Vision was O.U. 20/100, and the visual fields were as shown in figure 16. The discs were normal in appearance. A chronic left maxillary and ethmoid sinusitis was present. The patient took 40 mg. of vitamin B<sub>1</sub> daily during five days of hospitalization and then 10 mg. of B<sub>1</sub> and 100 mg. of nicotinic acid daily at home. His vision improved slowly, and in four months was only O.D. 20/50—, O.S. 20/70+. He said that he had decreased his

developing the amblyopia, but had continued to take about 25 grams of yeast daily.

Case 21. C. S., a 59-year-old Italian doorman, was seen at Vanderbilt Clinic on October 2, 1941. His vision had been getting worse for the past year. He was a heavy smoker, using eight cigars daily and a package of tobacco every three days. He drank very little, only two glasses of wine daily with meals. His teeth were in poor condition, but he said they were no worse than they had been for years. The patient was on a diet for diabetes. Vision was O.D. 20/200, O.S. 20/70, and the fields were as shown



in figure 17. The discs appeared to be normal. The blood sugar was 197 mg. percent; a 24-hour urine analysis showed a 4+ sugar reduction. The patient was placed on 24 c.c. (2 teaspoonfuls, three times daily) of Betaplexin; he continued his usual consumption of tobacco and alcohol, and returned to the Clinic at intervals of several weeks. In one month there was no improvement; in two months vision was O.D. 20/70, O.S. 20/50—; in three months O.D.

to be normal, but the visual fields were as shown in figure 18. On questioning, he stated that he smoked two cigars and six cigarettes daily but almost never took any alcoholic liquors. However, for the past six months his teeth had been in such poor condition that he had changed his diet. Only a few teeth were remaining in the upper jaw, and the patient had been intending to have these removed and get false teeth. His diet seemed inadequate. His

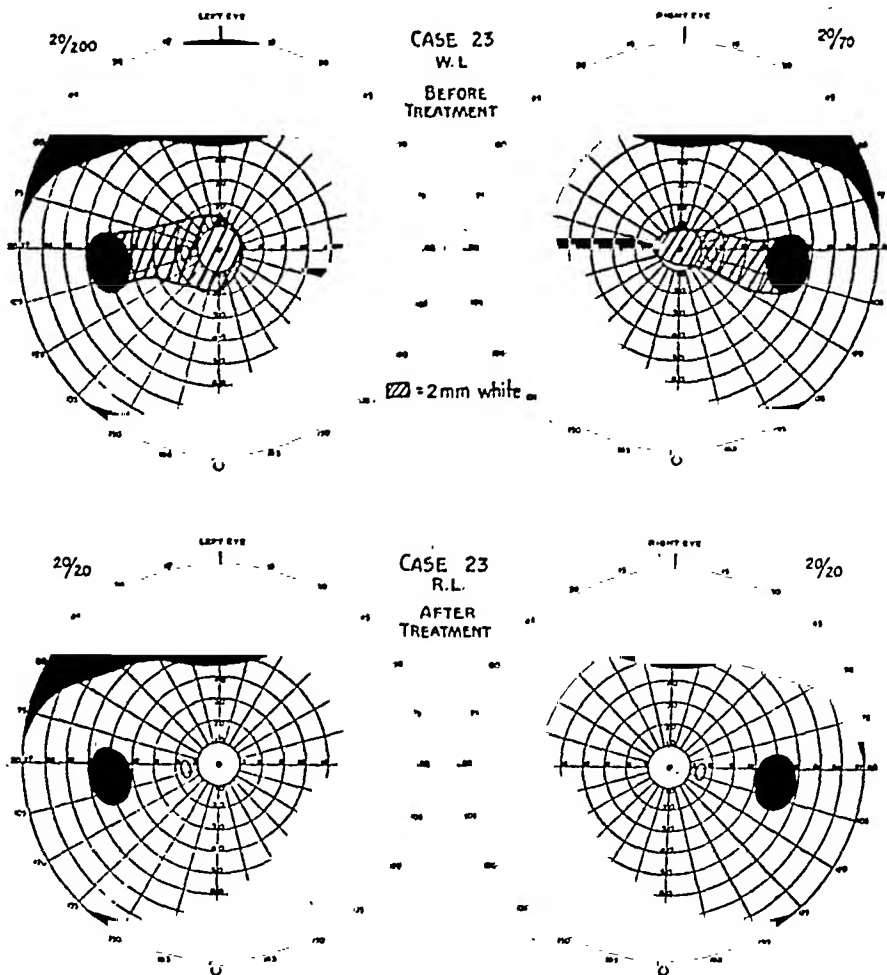


Fig. 19 (Carroll) Case 23. Fields of W. L.

20/50, O.S. 20/40; in four months O.D. 20/20—, O.S. 20/20—. The Betaplexin dosage was continued in the same amount and 10 mg. of vitamin B<sub>1</sub> daily was also taken. At the present time (June, 1942), the visual acuity is the same and the fields are as shown in figure 17. He has not decreased the use of tobacco or alcohol.

Case 22. H. F., a 45-year-old printer, had found it increasingly difficult to set his print for the past two months. When first examined, on March 16, 1940, his vision with correction was O.D. 20/40, O.S. 20/70; the fundi appeared

family physician, who happened to be his next-door neighbor, confirmed what the patient stated regarding a very moderate use of tobacco, no intake of alcohol, but an inadequate and unbalanced diet. He asserted that the patient would eat only what he liked and since his dental condition had become so bad his choice of food was even more limited. The patient took powdered brewers' yeast, 4 tablespoonfuls daily in milk. In one month the vision had improved from O.D. 20/40, O.S. 20/70 to O.D. 20/20—, O.S. 20/30+. In four months vision

was O.D. 20/15, O.S. 20/20; no scotoma was present for even the smallest red test objects. He was smoking his usual number of cigars and cigarettes. At that time the yeast was stopped on the condition that he take a well-balanced diet, which was carefully outlined. Three months later the visual acuity was unchanged; namely, O.D. 20/15, O.S. 20/20.

Case 23. W. L., a 60-year-old unemployed

buy the right foods. The Food Clinic, however, was able to prescribe a high vitamin-B diet at no increase in cost to the patient. He also took 8 tablespoonfuls of yeast daily. Improvement was gradual. In three months vision was still only 20/70, O.U., in five months it was O.D. 20/40, O.S. 20/50; in seven months 20/30—, O.U.; and in eight months 20/20, O.U. No scotoma was found at this time (fig. 19). The

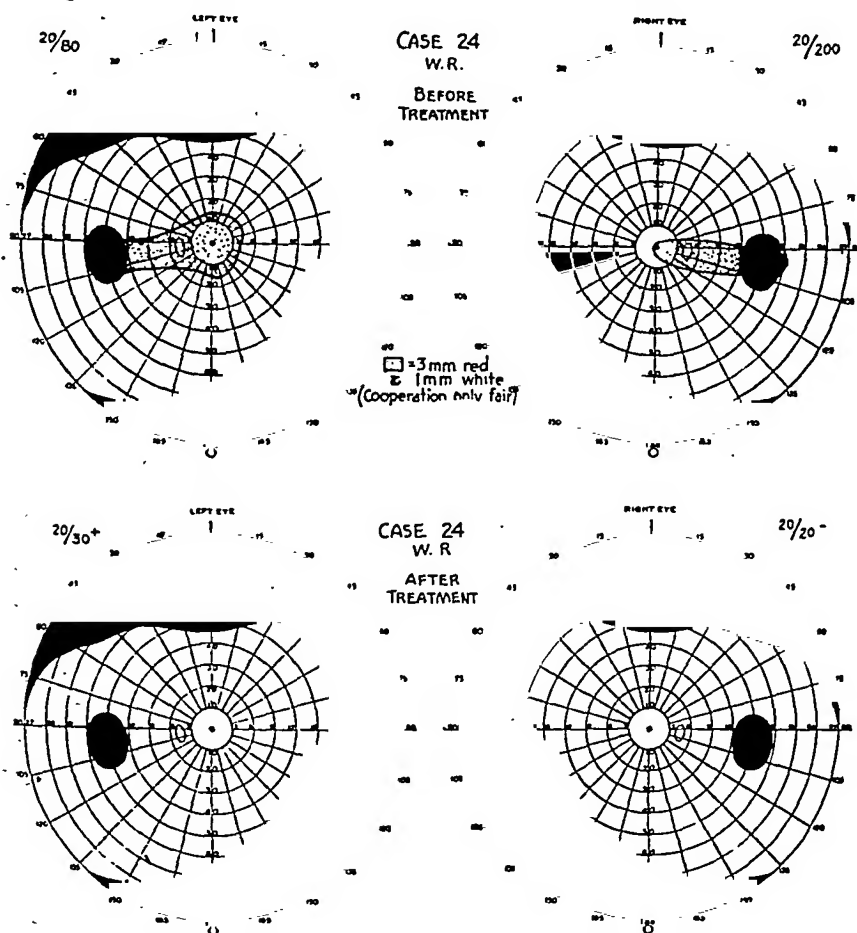


Fig. 20 (Carroll). Case 24. Fields of W. R.

salesman, came to Vanderbilt Clinic on December 7, 1936. He had been unable to read newspaper for three months, and new lenses from an optometrist had not improved his sight. Vision was O.D. 20/70—, O.S. 20/200 with correction. The fundi appeared to be normal, but the fields were as shown in figure 19. He smoked four to six cigars daily but had not had any alcoholic drink in a year. In fact he was sure that he had not had more than one drink a year for the past 10 years, and his wife confirmed this. In the last year he had lost 15 pounds in weight, and his diet was low in all vitamins and even in calories. He explained this by saying that he just did not have enough money to

patient had never decreased his smoking during these eight months but continued to take several teaspoonfuls of yeast daily. The results of a complete medical examination, which of course, included a urine examination, were negative. The patient, however, returned nearly two years later. He had lost more weight and was found to have a mild diabetes which could be controlled by diet without the use of insulin. He was last seen on August 25, 1942, five years after the onset of the amblyopia. Vision remained excellent. He had continued to take small amounts of yeast because he was on a somewhat restricted diet due to the diabetes.

Case 24. W. R., a 38-year-old Negro, came to

Vanderbilt Clinic on June 14, 1937. One year previously his vision had been sufficient to pass a driver's test in New York, but for the last five months it had grown progressively worse. Vision was O.D. 20/200, O.S. 20/80; the fundi appeared to be normal, and the fields were as shown in figure 20. At first he said that he took only a few drinks a day but finally ad-

min B, and 1 oz. of cod-liver oil. At first he was allowed to take one pint of liquor daily. This was gradually increased until he was consuming one quart, 4 oz.—that is, 36 oz. of liquor daily—the largest amount ever given to one of these hospitalized patients. He smoked his usual number of cigars and also began smoking a pipe. After one month of this regimen

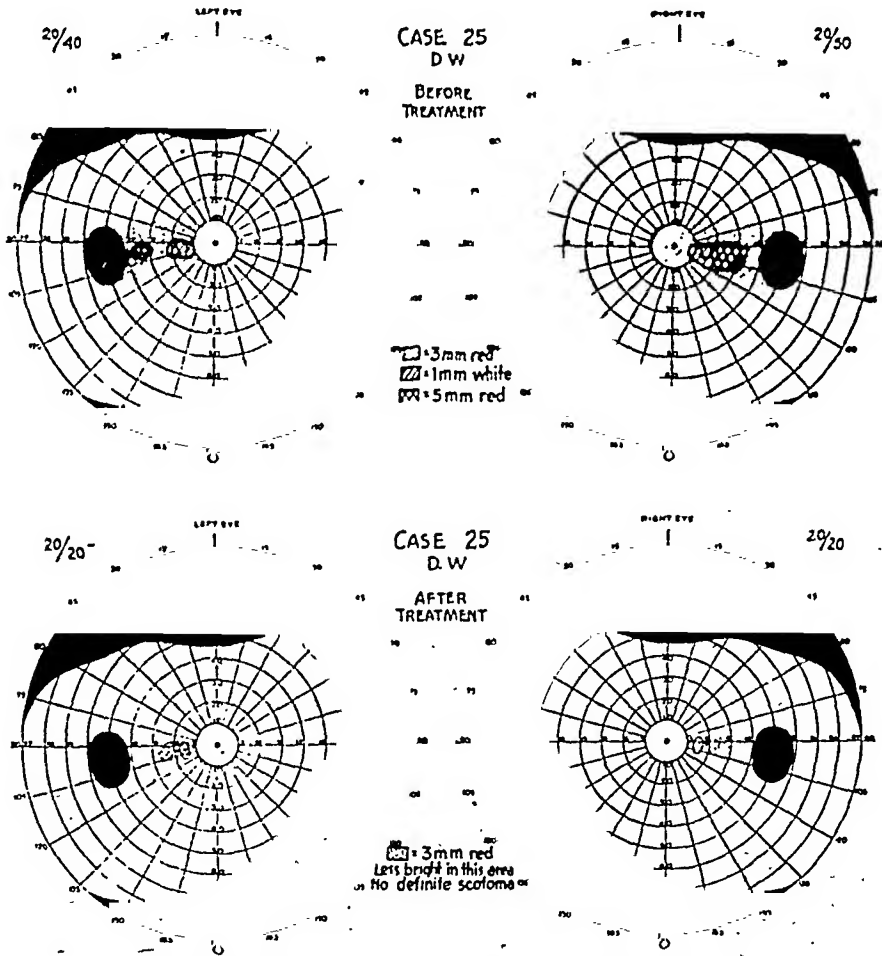


Fig. 21 (Carroll). Case 25. Fields of D. W.

mitted to taking about a quart of corn whisky daily until four weeks ago. Then, because his vision was decreasing, and he was having pains in his hands, feet, and the calves of his legs, he decreased his alcoholic intake. He was also a heavy smoker, using from 6 to 10 cigars daily. The patient was admitted to the Eye Institute, where a general physical examination revealed the presence of an enlarged liver. The results of a gastric analysis, blood and spinal-fluid Wassermann tests, and all other laboratory examinations were negative. The patient received daily 8 tablespoonfuls of brewers' yeast, 3 tablespoonfuls of vegex, 5 mg. of vita-

min B, and 1 oz. of cod-liver oil. The vision had improved from O.D. 20/200, O.S. 20/80 to O.D. 20/50+, O.S. 20/40-. Two weeks later it was O.D. 20/30-, O.S. 20/20-, and in two months, when last examined, it was the same. Visual fields showed no scotoma. He was drinking and smoking as much as ever.

Case 25. D. W., a 29-year-old colored housewife, had come to the clinic in an intoxicated condition on several occasions, and it was not until she was admitted to the Eye Institute on March 23, 1942, and allowed to go without alcohol for 24 hours that it was possible to plot satisfactory visual fields. She then stated that

she consumed one pint of rye whisky and one package of cigarettes daily. Vision with correction was O.D. 20/50, O.S. 20/40, and the visual fields were as shown in figure 21. Her diet had apparently been inadequate. On physical examination the liver was found to be enlarged. She was placed on a diet low in all vitamins and given 40 mg. of vitamin B<sub>1</sub> orally and 20 mg. intravenously daily. She received one pint of liquor daily at first and then this amount was increased slightly. She smoked one package of cigarettes daily. Within three weeks of her hospitalization on this regimen her vision im-

proved from O.D. 20/50, O.S. 20/40 to 20/20, O.U. She was then seen frequently in the clinic. On June 4, 1942, when last examined, the vision was 20/20—, O.U. No definite scotoma could be outlined. She had been advised to discontinue drinking a month previously when her vision reached 20/20—, but she persisted. In fact she admitted drinking more than ever. She had continued to take two 10-mg. tablets of vitamin B<sub>1</sub> daily.

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# X-RAY TREATMENT OF THROMBOSIS OF THE RETINAL VEIN AND OF SEVERAL TYPES OF IRIDOCYCLITIS

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## ORIGIN AND DEVELOPMENT OF THIS X-RAY TREATMENT

Because of the good results obtained by the use of X rays for the bleeding of myoma uteri, I began to apply X rays in cases of hemorrhagic glaucoma in 1919. This was primarily attempted in the hope of avoiding enucleation, which is usually necessary because of the headaches and pain caused by the eyes. The results of this treatment were so satisfactory that I published them in 1920. Since that time the method has been used by many ophthalmologists.

The indications for the use of X rays in cases of hemorrhagic glaucoma were extended to other types of this ocular affection; such as chronic, absolute, and secondary glaucoma. The effect upon chronic glaucoma is not surprising, in view of the influence of X rays on the retinal vessels; in cases of absolute glaucoma due to thrombosis of the retinal vein the same causes obtain. Only in cases of secondary glaucoma of another etiology must we assume that X rays have a greater influence on the uvea than on the retina. From the ophthalmologic literature on the subject the following 12 reports have been collected:

(1) In 1935 Basile treated for one year one case of thrombosis of the trunk and six cases of thrombosis of the branches; in 1936, from 3 to 28 months, 11 cases of glaucoma and thrombosis of the central vein. He administered in the first series: 1/6-1/9 H.E.D. once a week for 4 to 6 weeks; in the 2d series: 2mA, 23cm. F.H.D., filter: 1/2Zn + 5Al, field: 4:4. Total dosage, 6 cases: 1 H.E.D.; 1 case: 5/6 H.E.D.; 1 case: 3/9 H.E.D.; 3 cases: 1.5 H.E.D.; 1

case: 3 H.E.D.—at intervals of a week, 6 to 18 irradiations. The *results* were gradual diminution of pain from the first to the fourth irradiation; absorption of hemorrhages; vision not improved; in 4 cases diminution of the tension; in all cases disappearance of pain; no enucleation.

(2) Brunetti treated 3 cases of hemorrhagic glaucoma, 1 case with inflammation of the retina caused by pregnancy. He administered 16 to 45 units by Holzknecht in 2 to 3 treatments over a period of 3 to 4 weeks. The *results* were: in the cases of hemorrhagic glaucoma, diminution of pain after 6 weeks; in the case with the inflammation of the retina, rapid diminution of pain.

(3) Gradle treated 9 cases of thrombosis of the trunk and 7 cases of thrombosis of the branches with 1/4 to 1/3 H.E.D. in 3 treatments. The *results* were: vision not improved; absorption not accelerated; but the method is suitable for the prevention of increased intraocular pressure.

(4) Hess treated 12 cases of absolute glaucoma and 3 cases of secondary glaucoma for 5 years. He administered 500r at 1 time in a frontal and a temporal field; total dosage to the eye 800r. The *results* were: after 4 to 6 weeks 12 patients free from pain; diminution of tension; 3 enucleations.

(5) Hessberg treated for 2 to 5 years 9 cases of hemorrhagic glaucoma. He administered 14 to 20 X with a filter of 2 to 4 Al at intervals of from 8 to 14 days; 2 to 4 treatments. The *results* were: absence of pain after the first or second treatment; in a few cases diminution of tension.

(6) Hoffmann treated for 2 to 5 years

4 cases of hemorrhagic, 9 cases of chronic, and 10 cases of secondary glaucoma. He administered for hemorrhagic and chronic glaucoma 540r with hard rays in 2 to 3 treatments for a week; for secondary glaucoma 360r within 2 to 3 weeks. The *results* were: diminution of pain but generally not of tension.

(7) Kreibitz treated 10 cases of absolute glaucoma (only blind eyes). He administered 150r in 3 treatments with an interval from 1 to 2 days; series repeated after 1 to 2 weeks. The *results* were: diminution of pain (12 eyes); little diminution of tension.

(8) Saul treated for 1.5 years 3 cases of thrombosis of the trunk, 8 cases of thrombosis of the branches, and 7 cases of secondary glaucoma. He administered to blind eyes 50-percent H.E.D., to eyes with some vision 15- to 30-percent H.E.D. hard rays, at intervals of 2 days, 4 to 5 times. The *results* were: effects in most cases seen after the first irradiation; good results in 12 cases; subsequently 3 eyes had to be enucleated; tension not influenced.

(9) Schnyder and Forster treated 7 cases of thrombosis of the vein. They administered 40r medium-hard rays, 3mA, filter: 0.5 Zn + 1 mm. Al, 3 treatments at intervals of 2 to 3 days. The *results* were: quick absorption of the hemorrhages; vision increased.

(10) Thiel administered to blind eyes with absolute glaucoma 4 times 40- to 50-percent H.E.D.; to eyes with some vision 25- to 30-percent H.E.D. The *results* were: pain disappeared.

(11) Wachner treated 3 cases of acute, 30 cases of chronic, and 24 cases of secondary glaucoma. He administered 50r, 170 KV, filter: 3 mm. Al + 0.5 copper, 2 to 3 times a week; series repeated several times at intervals of a week. The *results* were: 68.4 percent eyes free from pain, 22.8 percent without success; 8.0 percent

doubtful; irritation disappeared; tension not diminished.

(12) Zingale treated for 3 months 1 case of thrombosis of the trunk and 1 case of thrombosis of the branch. He administered 253E, filter: 1/2 Zn + 2 mm. Al, 4 to 5 treatments from 20 to 25 minutes, 2 series. The *results* were: improvement of the vision; absorption of the hemorrhages.

#### THE CAUSE OF HEMORRHAGIC GLAUCOMA

The complete obstruction of the trunk of the central vein frequently causes hemorrhagic glaucoma with violent pain and blindness of the affected eye. However, if only a branch is blocked the danger of losing the sight, and later the eye, is less. Although it is rare to find manifest glaucoma after a single attack of obstruction of only one branch, the sight is always in danger, and the outbreak of glaucoma is to be feared. In my opinion, the explanation for this tendency to produce glaucoma is to be found in the difference in pressure between the two eyes. In the affected eye the tension is already somewhat higher at the beginning of the disease, even before glaucoma becomes manifest, and in spite of the use of miotics. Careful tonometric measurements of both eyes several times a day bring out this difference. Sometimes it is only evidenced after the use of a provocative test. The tolerance of the affected eye is less than that of the sound one, and the tonometric measurements appear 1 to 2 degrees higher in the affected eye.

Obstruction of the central vein can be the cause or the consequence of glaucoma. Many authors describe hemorrhagic glaucoma as a secondary one, but important findings make it probable that glaucoma is the primary event. Verhoeff was one of the first writers to point out that secondary obstruction of the central vein is more frequent than primary blocking.

Salzmann, using a special histologic method, found that in 65 enucleated and selected glaucomatous eyes, alterations of the central vein were often present and deduced from this fact that the obstruction was frequently caused by glaucoma. The influence on the venous circulation caused by the rising pressure and later by the manifest glaucoma is generally of a mechanical type. Because of this fact we can understand why thrombosis of the trunk of the vein will be produced earlier and more rapidly in glaucomatous eyes. The steps in the development of the disturbed venous circulation are: compression of the intralaminar part of the vein, thickening of the walls, and shrinking of the lumen, leading to thrombosis, and obliteration of the vein. The alterations present in the venous walls are always the same whether in a serious case or a lighter one, but the frequency of so-called secondary glaucoma diminishes with the increasing seriousness of the state of the central vein. Even a slight hindrance to the venous circulation can cause a slight increase of pressure. One may therefore speak of a "circulus vitiosus" between the impeded circulation and the glaucoma, so that the hindrance of the venous circulation involves a rise of tension, and the higher the tension the greater the difficulties for the circulation.

#### EFFECT OF THE X RAY ON THE VEGETATIVE NERVOUS SYSTEM, THE VESSELS OF THE RETINA, AND THE TENSION OF THE EYEBALL

The principal objective of therapy of glaucoma is to control the most threatening symptom; namely, the rise of intra-ocular pressure. It is certain that X rays have a special influence on the vessels, perhaps through a shrinking of the veins, but it is not easy to understand this mechanism clearly. The following opinions on this subject have been expressed by different authors.

(1) Basile—(a) a destructive effect of the sensitive nerve endings diminishes the pain; (b) a diminution of the tension is due to the production of an irritation and an inflammation of the uvea.

(2) Hess—influence on the circulation through the sympathetic nervous system.

(3) Hessberg—(a) an influence on the sensitive nervous system diminishes the pain; (b) an obliteration of the veins and the capillaries diminishes the tension.

(4) Kreibitz—injury of the sensitive nervous system.

(5) Loewenstein and Reiser—increase of the "vis a tergo" and dilatation of the veins following hyperemia.

(6) Schnyder and Forster—(a) a dilatation of the central vein and the veins of the disc caused by hyperemia; (b) an increase of the "vis a tergo" in consequence of the simultaneous dilatation of capillaries.

(7) Wachner—injury of the sensitive nervous system.

(8) Weinstein—an influence on the vitreous; the glaucoma causes an increase of acidity due to an intumescence of a swollen vitreous.

The general effect of X rays is due to their influence on absorption, on the biologic reactions of the cellular activities, and on the radiosensitivity of the cells. The normal development of cellular activity depends very much on a proper balance of the vegetative nervous system (VNS), which enmeshes all tissues, especially vessels. The radiosensitivity, on the other hand, is controlled by the degree of irritability of the VNS. Different analyses performed by several authors point out that X rays have a remarkable influence on the VNS, consisting in a restitution of the normal function of the vasomotor nerves.

The relations between the sympathetic nervous system (VNS), the vessels of the retina, and the tension of the eyeball can be established in different ways:



(1) Experimenting on animals, Asher and Kajikawa found a relation between the permeability of the walls of the ocular vessels and the tonus of the VNS.

(2) Examining anatomically the short ciliary nerves, Ernyei found that their ganglion cells belong to the sympathetic ganglion of the carotid plexus, not to the ciliary ganglion, and that the nonmyelinated nerve fibers in the vicinity of the ciliary nerves are a direct continuation of the carotid plexus. Ernyei therefore concluded that the VNS has a great influence on the reflexes of the eyes, especially those of the ocular vessels and their mechanism.

(3) Thiel experimented pharmacologically with ergotamin (gynergen) which paralyzes the sympathetic nerves and diminishes the intraocular pressure. He stresses the fact that the influence of ergotamin on the vessels in the normal and the glaucomatous eye is due to a diminution of the permeability of these vessels.

(4) According to the experiments of Schoenberg the normal chemical process producing acetylcholine is disturbed in the glaucomatous eye. The result is an oversensibility with increasing esterase in the affected eye. That is, to fight glaucoma the endings of the parasympathetic nerves have to be irritated in order to restore these normal chemical processes and check the rise of an excess of esterase.

We can therefore assume that it is the VNS which is influenced by X rays in the following way: The first effect reaches the fine endings of the ciliary nerves of the sympathetic ganglion of the carotid plexus which itself influences the mechanism of the ocular vessels. The result is a remarkable diminution of the irritability of the affected eye with diminution of or even freedom from pain. Afterwards, the vessels, including the capillaries, become dilated, inflammation is reduced, nodes are reabsorbed, and cicatrization follows.

If this process continues, the vessels reopen and the discharged substances are carried away. However, since X rays do not always have the same influence in every case, a careful dosage is necessary, according to: (1) the clinical state of the eye, (2) the purpose desired.

In many cases it is possible that a moderate application of X rays will have a rapid effect with good absorption, but in serious cases of severely damaged eyes, a blocked vessel trunk, and manifest glaucoma, a higher dosage is generally necessary. With the small doses of radiation that are sufficient for these eyes, it is practically impossible that the body should be affected.

#### TYPES OF X RAYS AND THEIR EFFECTS ON THE OCULAR TISSUES

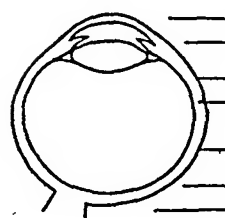
We have at our disposal weak, medium-hard, and hard X rays. Their influence on the different parts of the eyeball is shown by the figures in table 1. These figures are taken partly from Professor Reis's report, and were partly the results of my own experiments, conducted at my former hospital (Municipal Eye Hospital at Essen), which gave practically the same values. Weak rays are useful only for diseases in the vicinity and in the superficial parts of the eyeball. They become less efficient even directly under the superficial layers of the cornea. The influence of medium-hard rays extends throughout a larger zone, from the deeper parts of the cornea to the retina and the back of the eye. By changing the strength and the composition of the filter material one obtains many possible uses of mixed qualities of X rays. The kind of filter has to be adapted to the particular state of the disease to be treated. Hard rays are dangerous in this type of treatment because they have a deeper area of action and cannot be controlled in order to prevent severe injuries to the tissues of the eye. When using a medium-hard quality of

X rays in the treatment of uveal and retinal diseases, there is no danger in damaging healthy tissues because any part of the eye with balanced VNS will not be affected; that is, only pathologic tissues are radiosensitive.

Medium-hard rays are produced by a filter of 0.5 copper + 1.0 mm. aluminum.

TABLE 1  
DEPTH OF PENETRATION OF X RAYS  
INTO THE EYE

In order to show the depth of penetration of the X rays into the eye, there is appended the diagram below.\* The eye can be subjected to treatment of 3 different kinds of rays: weak, medium-hard, and hard. The reader can see at a glance the influence of these different kinds of X-rays on the different parts of the eyeball. The effect of weak rays on the uvea and the retina is slight, of hard rays too strong. Therefore, I prefer medium-hard rays for the treatment of the diseases in question.



Mm.	Weak Rays	Medium-hard Rays	Hard Rays
0	100	100	100
5	55		105
10	40		
15	30	100	
20	25		
25	21	95	105
30	18	90	100

\* Diagram and figures are reprinted from "Traité d'Ophthalmologie," volume viii, page 211, with the permission of the author, Prof. Reis, formerly at Strasbourg (France) and the publishers Masson et Cie, Paris. (This diagram also appeared in the writer's paper published by the Schweiz. med. Woch., Bale, 1940, v. 94, p. 954.)

The irradiation causes a diminution of the irritability of the VNS. The effects are as follows: (1) mitigation of pain brought about by a change in the cell function and in the tension of the tissue; (2) cicatrization of the pathologic area—small doses bring about an irritation followed by retrogression and regeneration; larger ones cause production of connective tissue and shrinking of the vessels; (3) absorption of hemorrhages and improvement of

blood circulation; (4) regulation of the intraocular pressure—the tension falls, more or less, in cases of hypertensive iridocyclitis, and in cases of iridocyclitis with hypotonia the tension rises.

The effect of X rays begins immediately after the first irradiation. According to findings by David and Gabriel, the reaction of X rays can be seen with the capillary microscope a few days before it is observable macroscopically.

The danger of an erythema of the skin of the eyelid is less with medium-hard rays than with weak ones. The intervals between the different applications of irradiation must be fixed according to the gravity of the disease and the individual sensibility, varying from 2 to 8 days or 2 to 8 weeks. The irradiation should end when its purpose is achieved. The necessary quantity of X rays is called "the total dosage of influence" and it should be adapted to the particular case treated. The definite effect of X rays often comes later. One must be careful to avoid an overdosage whose influence is unknown, waiting a certain period before the results are attained, and not be discouraged if this effect is delayed.

#### SEVERAL TYPES OF IRIDOCYCLITIS

##### TUBERCULOUS IRIDOCYCLITIS

The types of uveitis that respond best to treatment with X rays are tuberculous, traumatic, and hypertensive iridocyclitis. In tuberculosis of the iris and of the ciliary body one must be especially careful because of the great sensitivity of these pathologic tissues, otherwise there is danger of making things worse by causing a stronger irritation or even by injuring the sight. Most of the writers indicate a preference for small doses at shorter or longer intervals. The methods of a few ophthalmologists which I consider of a fundamental importance are the following:

(1) Werdenberg-Davos (Switzerland) used a type of X rays a medium between weak and medium-hard rays. The first single dose is 2.5- to 5-percent H.E.D. The total dose is 20-percent H.E.D.; the total dosage a year is 60-percent H.E.D.; the intervals are days or weeks according to the state and the reaction. He intended to prevent early reactions and injuries by X rays. Of 3,000 treatments by X rays he saw only 4- to 5-percent reactions.

(2) Stock and Scheerer used hard rays with 20-percent H.E.D. as a single dose, no more than 60-percent H.E.D. a year. The irradiations are given at intervals of 6 weeks without injuries or undesired reactions.

(3) Negru and Michael used medium-hard X rays with 50r as a single dose three times up to 150r as total dosage. The irradiations are given at intervals of 4 days; if necessary repetition of the series after 6 weeks.

As for myself, I used medium-hard X rays with 12 to 15r as the first single dose up to 50r; total dosage a year 300r (60-percent H.E.D.) the irradiations are given at intervals of 4 to 8 days, the later ones at 4 to 8 weeks' or months' intervals. Most important is a careful selection of the cases and exact regulation of the dosage and the intervals after each treatment. I have observed the best effect with the use of protracted and fractioned small doses. The ophthalmologist should always indicate to the roentgenologist the dose that is desired in every case. If the patient stands this dosage, injury to the eye will probably be impossible. It must be remembered that in comparing one's own results with those of other writers the different types of diseases and also the environment in other countries must be taken into account. Furthermore, the X-ray treatment is only a part of the complete treatment and is aided by the other special and usual remedies.

In case of tuberculous iridocyclitis the ocular reactions to the different treatments and also to the X rays are extremely sensitive, resembling the common therapy with tuberculin. The best results are found in the productive forms of the tuberculous iris. In the secondary stages of the illness, especially in the later periods, the effect is less, and in the exudative forms results are uncertain and undesired reactions possible. Often the patient feels a relief in the affected eye almost immediately after the first irradiation, but normally improvement will be noted a few days later. If the tuberculous uveitis reaches the deeper parts of the ocular tissue, X-ray treatment becomes uncertain and even unsuccessful.

#### HYPERTENSIVE IRIDOCYCLITIS

One of the most dangerous complications of the various types of iridocyclitis and especially of the chronic forms is the appearance of a sustained hypertension. Often none of the numerous conservative and surgical treatments are strong enough to regulate the pressure. The rise in tension is due to productive and exudative eruptions as well as to small thromboses. In such cases the doses of X rays have to be higher, especially if the eye is already blind. Complete normalization of the tension is not necessary to quiet the blind eye. A relative diminution may be sufficient to end the inflammation and the pain.

#### TRAUMATIC IRIDOCYCLITIS

Iridocyclitis of traumatic origin holds a special position among the different types of iridocyclitis. Serious injuries of the eye, such as perforation of corneal or sclerotic tissues by a foreign body, are generally accompanied by posttraumatic iridocyclitis in spite of careful surgical treatment of the wound and the extraction of the foreign body immediately after the accident. The gravity and the extent

of the iridocyclitis depend on the injury, on the infection brought about by the perforation, and the foreign body. Many such eyes have to be enucleated. It is obvious that there is danger of sympathetic ophthalmia in every case. A great many ophthalmologists, therefore, prefer an early enucleation, particularly in cases of extensive injuries where there is no hope of saving any sight. Although I fully realized the justification for this point of view, I felt that I should try to conserve these eyes as long as it was possible without danger of an outbreak of sympathetic ophthalmia. Particularly if children become blind in one eye by an accident, the growth of the skull goes on more regularly and symmetrically on both sides of the face if the orbit is not empty. It seems to me therefore of considerable advantage to save such eyes for a certain time, at least, if not for ever. Wearing a glass eye is not the same as possessing one's own painless eyeball; one is blind, to be sure, but makes a good appearance. Even if the quieted eyeball has shrunk, a glass eye worn over it looks and moves better than one worn in the empty orbit.

The earlier the irradiation begins, counting from the first day of the injury, the better the effect. I therefore systematically apply in such cases an early protracted and fractioned X-ray treatment after the first surgical care. By doing this it is attempted (1) to retain the shape of the seriously injured eyeball; (2) to conserve the actual sight. The doses in this type of iridocyclitis have to be higher than for other types of iridocyclitis and given at shorter intervals. The first irradiation is given from the 3d to the 6th day after the injury with 50r to 100r of medium-hard type of X rays. According to the special conditions of the particular case this dosage is repeated once or twice, or, if possible, 25 to 50r is given between the

3d and the 10th day after the first irradiation. On an average quieting the injured eye takes a total of 150 to 300r. There is no danger in approaching the higher limit of compatibility, even in reaching the maximum dose.

#### FIGURES AND CASES OF POSTTRAUMATIC IRIDOCYCLITIS

In my former hospital, situated in the middle of a large industrial district, I had to handle continuously many severe ocular injuries due to industrial accidents. This gave me the opportunity of testing the method described. In 1924 I reported the results of 44 such cases: 60 percent of the eyes were quieted, 23 percent had to be enucleated. From then to 1933 I continued using X rays for a large number of ocular injuries and obtained good results. Conditions at the time prevented me from reporting the figures. In 1939 and 1940 I was able to use the method in 8 cases at the University Eye Hospital at Lausanne\* (Switzerland, Director: Professor Amsler). I wish to take this opportunity to express my sincerest thanks to Professor Amsler for his understanding help and permission to use my method. Short excerpts from the case-notes are as follows:

*Case 1.* Jean V., 40 years old, on September 17, 1939, sustained a perforating injury of the left eye by a foreign body (iron) which produced a double perforation of the eyeball and became embedded behind the eye in the orbit. Severe hemorrhage in the interior of the eye. No red reflex from the eye. Projection of light uncertain. Posttraumatic iridocyclitis. In view of the situation of the foreign body in the orbit without contact with the eyeball, an attempt to extract the foreign body was abandoned.

*Irradiation:* September 29th, 50r.

\* Presented at the meeting on February 25, 1940, of the "Groupe Ophtalmologique du Léman" at the Hôpital Ophtalmique at Lausanne (Switzerland) together with a demonstration of the treated patients. Published in the "Schweiz. med. Wochenschrift 1940, v. 94, p. 954.

**Results:** October 10th, the injured eye became pale; iridocyclitis in a state of retrogression; no pain in the eye when touched. The patient had to leave the hospital for personal reasons and the irradiation was therefore interrupted, remaining incomplete. February 16, 1940. The left eye free from irritation and pain; tension low; the right eye normal without any sign of irritation.

**Conclusions:** This is an incomplete and insufficiently treated case, only mentioned as one of the whole series; nevertheless a certain influence of the irradiation can be admitted since the retrogression of the iridocyclitis and the quieting of the eye would probably not have occurred so quickly without this treatment.

**CASE 2.** Paul P., 49 years old, on September 25, 1939, sustained a severe perforating injury of the right eye by a large foreign body (iron) which did not enter the interior of the eye. Shortly after the injury there developed a violent posttraumatic iridocyclitis and an abscess in the vitreous. The eye was soft and painful when touched.

**Irradiation:** October 2d, 50r; October 5th, 50r; October 8th, 25r, at 3 days' intervals; total dosage, 125r.

**Results:** The irradiation had no effect; therefore, on October 10th, the eye was enucleated.

**Conclusions:** The section of the eyeball showed that there was a large horizontal tear through the cornea and sclerotic reaching the equator of the eye. The lips of the sclerotic wound were not adapted, but overlapped; hence healing of the wound was impossible and X-ray irradiation could be of no use.

**CASE 3.** Henri B., nine years old, on January 28, 1939, sustained a perforating injury of the left cornea by a knife stab. There existed a prolapse of the iris which was cut off immediately after the event, and the lips of the wound were sutured. In spite of a satisfactory healing of the external wound, iridocyclitis slowly set in. I saw the boy in this state during the first days of October, as he was being prepared for an enucleation. Irradiation with X rays, a long time after the injury had occurred, could only be a last attempt to conserve the eyeball in its shape for a few years, preventing trouble to the orbit and the face during the years of growth.

**Irradiation:** October 10th, 50r; October 13th, 50r; October 21st, 50r; October 24th, 50r; at intervals from 3 to 8 days; total dosage, 200r.

**Results:** Since the iridocyclitis and pain in the eye when touched remained, the eyeball had to be enucleated.

**CASE 4.** Josef D., 38 years old, on December 6, 1939, sustained a perforating injury of the sclerotic of the left eye without entrance of the foreign body. Suture of the wound. Post-traumatic iridocyclitis, pain in the eye when touched, low tension.

**Irradiation:** December 8th, 100r; December 13th, 100r; December 21st, 100r; December 30th, 50r; at intervals from 5 to 8 days; total dosage, 350r.

**Results:** January 10, 1940. Left eye pale and quiet. Cicatrization of the iridocyclitis. A little shrinking of the eyeball is seen. Tension still somewhat subnormal. No pain in the eye when touched. March 20, 1940. State unchanged. The eye remains pale and quiet. The patient is back at work.

**CASE 5.** Innocent P., 43 years old, on December 16, 1939, sustained a perforating injury of the left eye by a large foreign body (iron). Extraction of the splinter by means of the giant magnet. Shortly following the operation there developed a violent posttraumatic iridocyclitis with an hypopyon in the anterior chamber and an abscess in the vitreous. The eye became soft and very painful when touched.

**Irradiation:** December 26th, 50r; January 24, 1940, 50r; January 11th, 50r; January 17th, 50r; January 24th, 50r, at intervals from 6 days to 5 weeks; total dosage, 250r.

**Results:** The hypopyon in the anterior chamber and the abscess in the vitreous was reabsorbed very quickly. The eye became pale and quiet. Cicatrization of the iridocyclitis was seen. Tension rose. February 24, 1940. To make sure of the effect an additional irradiation of 50r was given 5 weeks after the last day of the series. April 30, 1940. The left eye showed no inflammation and remained quiet. No pain in the eye when touched. Iridocyclitis clinically healed. The patient works at his former job.

**CASE 6.** Léon B., 27 years old, on January 18, 1940, sustained a perforating injury of the left eye. No foreign body in the eye. Violent posttraumatic iridocyclitis. The eye become soft and painful when touched.

**Irradiation:** January 18th, 50r; January 22d, 25r; February 1st, 50r; February 11th, 50r, at intervals from 4 to 10 days; total dosage, 175r.

**Results:** The eye became pale and quiet. Cicatrization of the posttraumatic iridocyclitis occurred. The anterior part of the eyeball shrunk a little. Tension somewhat reduced. No pain in the eye when touched. The patient is back at work.

**CASE 7.** Oliver J., 47 years old, on March 15, 1940, sustained a perforating injury of the sclerotic of the left eye by a foreign body

(glass). Suture of the lips of the wound. Whether a foreign body remained in the interior of the eye or not was uncertain. The splinter of glass was not visible in the radiogram. Violent posttraumatic iridocyclitis with an hypopyon in the anterior chamber. The eye became very soft and painful when touched. There was only perception of light.

*Irradiation:* March 27th, 50r; March 29th, 25r; April 4th, 50r, at intervals of 2 to 18 days; total dosage, 125r.

*Results:* March 30th, the left eye had become pale and quiet. Hypopyon in the anterior chamber was reabsorbed. Precipitates on Descemet's membrane were seen. Cicatrization of the posttraumatic iridocyclitis occurred. Opacities in the vitreous. The fundus was invisible. Tension still low. Visual acuity, 1/20. May 1st, the injured eye remained pale; precipitates unchanged; the vitreous less opaque; tension normal; no pain in the eye when touched. Visual acuity, 0.3; the patient works at his former job.

CASE 8. Marcel E., 20 years old, on April 4, 1940, sustained a perforating injury to the cornea of the right eye with a prolapse of the iris. No foreign body in the eye. That same day the prolapse was cut away, and the lips of the wound were sutured. There was a big hyphema in the anterior chamber and a traumatic cataract was seen. The eye became soft and painful when touched. Visual acuity, perception of fingers at 1 m.

*Irradiation:* April 20th, 50r; May 3d, 50r, at an interval of 12 days; total dosage, 100r.

*Results:* April 30th, the injured eye became pale and quiet; the hyphema was on the way to resorption; the tension was rising and the pain in the eye when touched diminishing; visual acuity, fingers at 3 m. May 10th, the recovery continued; the irradiation was interrupted by external causes and had to be repeated to make sure that the first satisfactory effect would be maintained.

**SUMMARY.** The eight cases of post-traumatic iridocyclitis herein discussed were observed by me in the University Eye Hospital at Lausanne (Switzerland) from September, 1939, to April, 1940. During this period all cases of new or old perforating ocular wounds observed at the Hospital were given the X-ray treatment at random regardless of the effect it might have. I made an early report of such a limited series for I wished to

present them at the meeting in February, 1940. Later on, conditions at the time prevented me from supplementing the case-notes with the later clinical observations. In spite of these facts I deem these few and abbreviated case-notes of sufficient value to demonstrate the possibilities and the limits of the method. They represent seriously injured eyes, some of them accompanied by great loss of vitreous, violent posttraumatic inflammation, and purulent infiltration of the vitreous, which would have had to be enucleated if their condition had not been ameliorated by the X-ray treatment. Only in two cases was this operation necessary:

(1) In case 2, it was seen at the section of the enucleated eyeball that the wound presented unfavorable conditions for healing; therefore X-ray therapy was useless.

(2) In case 3, the injury was too old to permit any result from X rays to be obtained; on the other hand, the danger of sympathetic ophthalmia urgently demanded enucleation.

(3) In cases 4, 5, 6, the effect of the X-ray treatment was very satisfactory and in spite of severe inflammations of the injured eye enucleation was unnecessary.

(4) Particularly remarkable was case 7. The patient was a chauffeur by profession, and for him the continuation in his profession depended on the conservation of the injured eye with some sight. It seems to me to be more than doubtful whether such good results as normal tension and visual acuity of 0.3 were to be obtained by any other treatment than X rays.

(5) The treatment in cases 1 and 8 remained incomplete at the time when I had to finish my observations. Although supplementary irradiations are desirable, one can note the good effects of the X-ray treatment also in this state.

### GENERAL RESULTS OF X-RAY TREATMENT ON POSTTRAUMATIC IRIDOCYCLITIS

The results of X-ray treatment on posttraumatic iridocyclitis consist of: disappearance of the redness of the anterior part of the eyeball, diminution of inflammation, cicatrization, painlessness in the eye when touched, and a certain rise of pressure in cases of low tension. A complete normalization of the tension is not to be expected. If the eye has become quiet, one may speak of a clinical healing, and if good projection of light remains it is possible to operate later on, if necessary. It seems to me impossible that X-ray treatment by itself should cause sympathetic ophthalmia. On the other hand, to prevent sympathetic ophthalmia regular and careful examinations by an ophthalmologist are absolutely necessary. X-ray treatment should be tried only when the patient can reach his ophthalmologist quickly and easily. If not, early enucleation of the inflamed and injured eye is to be preferred.

### X-RAY TREATMENT FOR THROMBOSIS OF THE RETINAL VEIN

In cases of thrombosis of the trunk or of the branches of the central retinal vein I use X-ray treatment immediately after the first consultation. I assume that in all such cases glaucoma can easily set in sooner or later. The preservation of sight depends on the extent of the thrombosis and on the tension in the eye. In cases of trunk thrombosis, generally, blindness cannot be prevented, but thrombosis of the branches can be arrested, and perhaps the vision can be maintained or even improved. If X rays are used with correct dosage and systematically, it is possible in all glaucomatous cases to make the severe pain disappear and prevent enucleation. The regulation of the tension is of more relative value. Normal tension is not nec-

essary to quiet the irritability since chronic glaucoma can exist without any pain. The dosage for trunk and branch thrombosis must be different; it varies from 350 to 450r in the first instance and from 150 to 200r in the second. If pain and inflammation are violent the intervals between irradiations must be reduced by accelerating the rhythm of the treatment. In cases of complete obstruction of the venous trunk with glaucoma, X-ray treatment is completed when the eye has become quiet, and in cases of a partially blocked branch at the moment when the bleeding has stopped and an absorption of blood can be observed. Usually four to five applications are sufficient for this purpose. The scheme of these irradiations, using medium-hard rays and a filter of 0.5 copper and 1 mm. aluminum is seen in table 2.

If irritation of the external parts of the eye appears together with erythema of the skin of the eyelid and a more intensive injection of the conjunctival vessels, X-ray therapy should be discontinued until the irritation is over. The effect of the irradiation can be intensified in the weeks and months following; therefore, a definite judgment about the results attained is only possible after a long time. It seems best to me to reach the desired effect with the smallest possible quantity of X rays, but "too much" is as dangerous as "too little," and only by the use of correct combinations of dosage and intervals can we expect good results. The vessels are dilated or constricted under the influence of X rays. Dilatation is caused by irritative doses from 25 to 50r, generally totaling no more than 150 to 200r. This is important, especially in branch thrombosis when blood has to be absorbed as soon as possible to prevent early damage to the retina. Hence, to favor this we have to render the veins capable of transporting the thrombus before the retina is seriously af-



fect. In cases of trunk thrombosis only constriction doses can quiet the eye. Frequently a certain dosage must be used that can bring about the state of complete obliteration of the vein. Generally, a total

## CONCLUSIONS

1. X-ray treatment for the ocular diseases under discussion should be given at the earliest moment possible; namely, (a) in cases of injuries immediately or in the

TABLE 2  
I. THE PROTRACTED AND FRACTIONED EARLY IRRADIATION

Diagnosis	Single Dose	Intervals	Total Dosage
Posttraumatic iridocyclitis	1st treatment: 50 to 100r 2d treatment: 50 to 100r 3d treatment: 50r If an improvement is seen 4th treatment: 50 to 25r later on: 25r	3 to 10 days  3 to 10 days 2 to 4 weeks	150 to 300r
Thrombosis of the retinal vein (a) of the trunk	1st treatment: 50 to 100r 2d treatment: 50 to 100r 3d treatment: 50 to 100r If an improvement is seen 4th treatment: 50 to 25r later on: 25r	5 to 10 days   greater intervals	350 to 450 r
(b) of the branch	1st treatment: 50r 2d treatment: 50 to 25r 3d treatment: 25 to 15r later on: 15 to 10r	5 to 10 days  greater intervals	150 to 200r

II. THE PROTRACTED AND FRACTIONED IRRADIATION AT A SPECIAL TIME  
ACCORDING TO THE STATE OF THE DISEASE

Tuberculous	1st treatment: 12 to 15r If the 1st treatment is tolerated and the disease needs further treatment 2d treatment: 25 to 50r 3d treatment: 25 to 50r	4 to 8 days  4 to 8 weeks or months	no more than 300r a year
Hypertensive (glaucomatous) iridocyclitis	1st treatment: 50 to 100r 2d treatment: 50 to 100r 3d treatment: 50 to 25r later on: 25r (if necessary)	3 to 8 days 8 to 14 days	125 to 300r

of 350 to 450r is necessary. One need not fear general complications in the body, since the single doses for the eye are too small for such remote effect. It must be added that it is always useful to have a general medical and internal examination, made by an internist in collaboration with the oculist, also a careful general treatment, if necessary, since it is a known fact (which no longer needs to be stressed) that the principal causes of these ocular diseases are always to be found in the body.

first days after the injury or after the first surgical care; (b) in cases of thrombosis of the retinal vein after the first examination; (c) in cases of tuberculous and hypertensive iridocyclitis the decision as to the best moment for irradiation depends on the state of the injured eye.

2. X-ray treatment is best administered in protracted and fractioned small doses.

3. X-ray treatment has to be carried through systematically to the end, even if one has to wait longer than usual for good results.

Finally I wish again to point out that X-ray treatment of the ocular diseases under discussion must always be performed in close coöperation between ophthalmologist and roentgenologist. Both have to consider diagnosis and appropriate moment for the X-ray treatment in every case, the technical requirements necessary, and the patient's compatibility for this treatment. If all conditions are present, I believe that it would be possible to heal many serious diseases, to conserve eyes otherwise lost, and to aid a large number of sufferers.

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# ALMOST COMPLETE RETINAL DETACHMENT AFTER CATARACT EXTRACTION; COMPLETE REATTACHMENT AFTER GLAUCOMA ATTACK

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Spontaneous reattachment of detached retinas has been reported by numerous observers.<sup>1</sup> In fact the majority of ophthalmologists probably have seen such cases occasionally. The reattachment is sometimes only temporary, sometimes permanent. A number of cases have been reported in which detachment recurred repeatedly, always followed by reattachment sooner or later without surgical procedure and sometimes without any treatment whatsoever. Frequently, a considerable amount of function returned in the involved eye, although a permanent defect of vision and defects in the visual field resulted in most cases wherein the detachment had persisted over longer periods.

It is also well known that in many cases of retinal detachment variation of the intraocular pressure may be observed fairly regularly. Some observers have insisted that the tension was below normal as a rule almost immediately after the start of the detachment whereas others have found a drop in tension only after a considerable time has elapsed. On the other hand, it seems to be a well-established fact that in a fair number of cases of untreated retinal detachment, secondary glaucoma develops in the later stages of the disorder.

In spite of the tremendous amount of research work carried out during the past century, no completely satisfactory explanation has been given for either of the two processes; that is, for spontaneous reattachment or for the occurrence of secondary glaucoma following retinal detachment. Only in cases wherein the retinal detachment is caused by a true

exudation behind the retina (or, better, between the pigment layer and the retina proper)—for example, as in those occurring during pregnancy—is a reattachment fairly plausibly explained by resorption of the fluid by the choroid.

Since the publication of Leber's<sup>2</sup> very elaborate studies it has been a well-established fact that the formation of holes or tears in the retina itself or rents at the ora serrata plays a predominant part in the mechanism of retinal detachment by allowing fluid from the vitreous body to penetrate behind the retina. Recognition of the fact that the closure of such apertures by means of coagulation and reactive proliferation of scar tissue is of paramount importance led Gonin and many others (particularly Weve, Arruga, Lindner, and Walker) to develop modern methods of active treatment of this formerly hopeless disorder. It is true that the old conservative treatment with bed rest, pressure bandages, subconjunctival injections of hypertonic solutions and the like, had been used with some success in a limited number of cases. Fehr<sup>3</sup> believed that mechanical reduction of the size of the globe did help to bring the detached membrane into closer contact with the pigment layers, thus inducing reattachment. Since there is usually a free communication between the subretinal and the vitreous fluid through one or more openings in the detached retina it seems difficult to understand why pressure exerted upon the surface of the globe should bring the retina back into place unless some agent—that is, an inflammatory process—occludes the retinal hole through which the exchange of fluid takes place at the right

moment and the subretinal fluid is subsequently absorbed. There is no doubt that pressure bandages and similar appliances, such as plugs inserted into the conjunctival sac, invariably cause a rather violent inflammatory reaction with considerable reduction of the intraocular pressure, and it may be that these reactions play a more important part than the external pressure itself. Equally uncertain is the origin of secondary glaucoma in the later stages of retinal detachment. We know that a tendency to proliferation exists in the pigment epithelium when the retina is detached. The pigment layer grows considerably thicker, and large quantities of free pigment are deposited on the surface of the iris and in the chamber angle. This might cause an obstruction of intraocular exchange of fluid and lead to an increase of intraocular pressure. However, since the pigment accumulation in the anterior section of the globe usually occurs in the earlier stages, the development of a secondary glaucoma years after the detachment of the retina, rather than shortly after it, is not easily explained.

The literature contains a very few records of cases in which a spontaneous secondary increase in intraocular pressure caused flattening or reattachment of the retinal detachment. Attempts have been made to increase the volume of the vitreous artificially by injecting salt solutions or foreign vitreous materials<sup>4</sup> into the vitreous chamber after puncture or trephining of the sclera to release the subretinal fluid. It was assumed that the increase of pressure by the vitreous would bring the retina into contact with the choroid, and in a number of cases such procedures proved successful.

In 1928 Sédan<sup>5</sup> reported one case of an eye, affected by a chronic recurrent syphilitic iritis, which sustained a large retinal detachment after being hit by a tennis

ball. The eye showed total seclusio pupillae and developed a large retinal detachment with no visible holes. During the conservative treatment an acute secondary glaucoma started on the thirty-eighth day, accompanied by iris bombé. After double transfixation the tension came down to normal, and the retina became almost completely reattached, with the exception of a small area below, where a flat detachment remained. After three months the corrected vision was about 5/10 (as before) and the field of vision had returned to approximately normal limits. But this seems to be about the only case published so far wherein secondary glaucoma in an eye with retinal detachment apparently had a beneficial effect as to anatomic and functional repair of retinal detachment. Obviously such cases are extremely rare and I could not find any record of a case which, after an extensive retinal detachment that had persisted for a considerable length of time, developed acute glaucoma and manifested a complete recovery of function after the glaucoma attack subsided and the retina became reattached.

I have had the opportunity of observing such a case and feel justified in bringing it to the attention of my colleagues, particularly since it presents a number of unusual features.

#### CASE REPORT

H. T. W., a white farmer, 80 years old, consulted me for the first time on June 25, 1943, with the following history:

The patient had been quite well until 1925, when some intestinal trouble of uncertain nature eventually required surgical treatment. In September, 1925, the patient was operated upon for a duodenal ulcer. The operation was performed under ether anesthesia, during which apparently a complication occurred which the patient was unable to identify properly.

The anesthetist had "a hard time to bring him back." The day after the operation the patient noticed that his left eye had become blind. Curiously enough the patient did not tell his doctors anything about this incident. The hospital record does not contain any remark as to complications occurring during the operation or after it. Nor does it mention anything about the patient's monocular blindness. After a while some sight came back to the left eye, to the degree that the patient could distinguish between darkness and light. Later on visual acuity in his right eye decreased gradually, and about five years ago he consulted an oculist, who told him that he had a cataract in the left eye and prescribed drops for the right eye (pilocarpine?), which he used regularly, at least for some time. Nevertheless, the right eye continued to get worse gradually, and in November, 1942, the patient consulted another oculist, who advised and performed at that time the removal of the cataract in the left eye. The hospital record indicates that intracapsular combined extraction of a hypermature, senile, calcareous cataract was performed on November 17, 1942; that the operation was not complicated; and that the anterior chamber was irrigated with saline solution after the extraction. No vitreous was lost during the operation. The patient could see with the eye that had been operated on for some time, and a lens for distance was prescribed. However, the vision became gradually poorer after some weeks. The deterioration was accompanied by constant inflammation of the operated eye. Eventually the patient was taken to the hospital again on April 9, 1943, and advised to lie on his left side for some days. The hospital record on the second admission shows a diagnosis of "high detachment of the choroid, especially temporally and below." When the patient was released on April 19, 1943, the

detachment was "still high." The eye was practically blind. Gradually, the eye became more inflamed and painful but supposedly the patient received no further treatment until he came to me.

At my examination on June 23, 1943, the right eye was externally normal and showed no signs of congestion or inflammation. The cornea was clear, the anterior chamber somewhat shallow, the pupil was about 3 mm. wide and reacted promptly to light but not extensively. The lens showed moderate sclerosis but no cataract. Ophthalmoscopic examination revealed a very deep glaucomatous excavation and almost complete atrophy of the optic disc. The intraocular pressure was above normal.

The left eye was moderately congested and showed pericorneal injection. The corneal surface was smooth and reflected normally. In the region of the upper limbus a slightly depressed scar (from cataract operation) formed a shallow furrow between the limbus itself and a somewhat protruding area of the sclera parallel to the scar resulting from the operation. Ingrowth of epithelium had formed a fairly dense gray film at the upper part of the posterior surface of the cornea, with a tongue-shaped process in front of the center of the iris coloboma extending downward about halfway between the center of the cornea and the chamber angle. The anterior chamber was very shallow, almost obliterated in the upper third, where the nasal and part of the temporal pillar of the iris coloboma was attached to the rear surface of the cornea. The chamber fluid contained some floating cells, but no precipitates were visible. The iris was slightly discolored and hyperemic. A very delicate membrane was attached to the pupillary margin, spreading upward into the medium-sized operative coloboma. The lens was absent.

*Ophthalmoscopic examination revealed*

almost total detachment of the retina with the highest elevation in the temporal section. The detachment reached almost to the median vertical plane, was also high in the lower section, and extended almost to the optic disc, apparently also involving the macular region. In the nasal section the detachment was much flatter. Holes or tears could not be detected. However, the somewhat narrow pupil and the partial obscuration of the cornea prevented sufficiently thorough examination of the peripheral parts of the fundus.

In the left field gross objects were seen in a limited temporal area. Central vision was nil (fig. 1).

Diagnosis: O.D., advanced glaucoma simplex. O.S., aphakia; postoperative retinal detachment, mild uveitis with hypotension.

On June 28, 1943, the condition was about the same, the tension in the right eye 28 mm. Hg. Repeated instillation of 2-percent pilocarpine hydrochloride brought the pressure down to 19 mm. Hg. The patient was advised to use this solu-

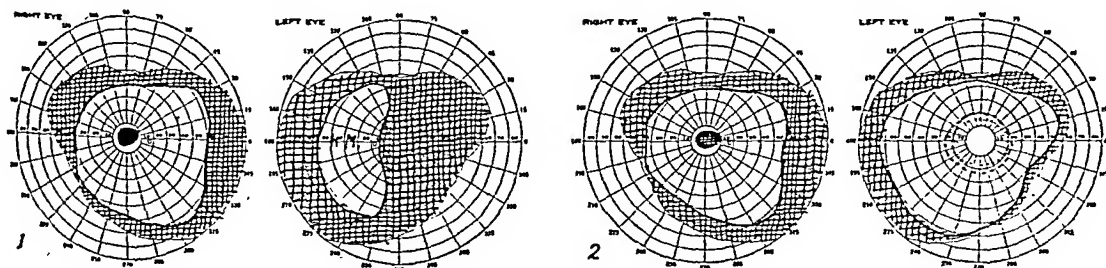


Fig. 1 (Nelson). Visual fields as of June 28, 1943. Fig. 2, Visual fields as of October 8, 1943. Dotted line, red; dash, blue.

The detachment was definitely retinal and not choroidal, showing the characteristic gray color. The optic disc was of normal color and apparently not excavated. Instillation of fluorescein revealed no leakage nor fistula in the operative wound or elsewhere.

Tension, measured with the Schiötz tonometer, using 5.5 gm. weight: right eye 30 mm. Hg, left eye less than 5 mm. Hg.

Vision: O.D., 5/100, not improved with glasses; O.S., with +10.0D. sph. was sufficient only for finger counting at 1 m. distance, excentrically, in the temporal field alone.

The right peripheral field of vision was only moderately concentrically contracted for white objects (10 mm.<sup>2</sup>) Colors were not recognized. The central field showed a scotoma of not quite 10 degrees.

tion in the right eye three times daily. On July 6th the tension in the right eye was down to 17 mm. Hg. The left eye was less tender and inflamed but still as soft as before.

Since the prognosis for the left aphakic and highly hypotonic eye with the large detachment that obviously had started five or six months ago was extremely dubious it did not seem advisable to try a diathermy operation, the advanced age of the patient (80 years) being another grave obstacle. It was therefore decided to concentrate on the right glaucomatous eye that responded very well to mydriatics and enabled the patient to get around fairly well.

On the morning of July 12, 1943, the patient, who lives out of town, returned because the preceding evening his left eye had suddenly become very painful and inflamed. It was very congested, sensitive

to light, and hard, showing the complete picture of an acute inflammatory glaucoma. The cornea was hazy, the conjunctiva bulbi moderately chemotic. Tension was 57 mm. Hg (Schiotz) in the left eye, 19 mm. Hg in the right eye. Two-percent pilocarpine hydrochloride was instilled into the left eye immediately and repeatedly, and after one hour the tension came down to 35 mm. Hg. At 2 p.m. it was again up to 48 mm. Hg. The patient was advised to put one drop of the same solution into his left eye every hour. The next morning he felt much better, and the left eye no longer pained him. The tension was O.S. 19 mm. Hg, but the eye still showed considerable congestion. The patient instilled the pilocarpine solution 3 times daily and felt comfortable. Two weeks later the left eye was still slightly irritated but the tension was again 19 mm. Hg. On August 25th both eyes were quiet and the tension was O.D. 18 mm. Hg, O.S. 20 mm. Hg.

On October 1st the patient returned for another check-up. The condition of the right eye was unchanged. The left eye showed a very faint diffuse episcleral injection, but was no longer tender to the touch. Tension O.D. 22 mm. Hg; O.S. 22 mm. Hg. The patient seemed to move about much more freely and surely. When I examined his left eye with the ophthalmoscope I was greatly surprised to find a normal bright red reflex from all over the fundus. The detachment of the retina had completely disappeared, not even folds of the retina could be detected at any place. My question if the patient had noticed a remarkable improvement of vision in the left eye was answered in the affirmative. As a matter of fact the vision of the left eye with +10.5D. sph.  $\approx$  +2.5D. cyl. ax. 180° was now 5/10 partly; with +14.0D. sph.  $\approx$  +2.5D. cyl. ax. 180° the patient could read Jaeger 5. On October 8th the vision with the same

correction was 5/6— and Jaeger 1. In the right eye the field of vision was unchanged. The left field, however, was almost normal for 10-mm.<sup>2</sup> gray objects. The color field was present for all colors although considerably contracted concentrically (fig. 2).

Since a change in the refraction of the left eye could hardly be expected in the future a bifocal lens with the refraction mentioned above was prescribed. On November 30th the corrected vision was O.D. 5/75, O.S. 5/5 partly and Jaeger 1. The left fundus showed absolutely no trace of the previous retinal detachment. A number of floating opacities could be seen in the vitreous body. The anterior chamber was still as shallow as before. The condition has since remained unchanged. The tension in both eyes varied between 19 and 22 mm. Hg. When tested last on December 14, 1943, the color fields were about 10 degrees wider than on October 1.

It does not seem very probable that the diagnosis "choroidal detachment" was correct. Postoperative separations of the choroid after cataract and glaucoma operations are not uncommon. However, almost all experienced observers agree that such an event usually occurs earlier, one day to a week after the operation, most frequently on the fifth day, and that, as a rule, spontaneous reattachment takes place after short duration. If a choroidal detachment persists for any length of time it is often a hemorrhagic detachment, which generally leads to shrinkage and destruction of the globe. Czermak<sup>6</sup> reported a choroidal detachment several months after a cataract operation. One case has been described by Bothman,<sup>7</sup> in which a choroidal detachment persisted eight months after an Elliot trephining operation and was cured after transplantation of a piece of tendon over the leakage. Löhlein<sup>8</sup> reported another case in



which choroidal detachment occurred nine months after a cataract extraction. A leak was found also in this case, and healed with cauterization of the fistula and transplantation of a conjunctival flap.

I incline to the view that our patient's eye underwent a primary retinal and not a choroidal detachment. No fistula could be found at any time in the scar with the fluorescein method and slitlamp examination. A choroidal detachment was particularly unlikely as the detached membrane showed a very high elevation in the entire temporal and lower sections of the eye-ground, and the elevation included the whole area from the extreme periphery to the close vicinity of the optic disc. Separation of the choroid to such an extent would be impossible without severance of at least the temporal and lower vortex veins. Such severance would inevitably result in a disastrous and irreparable sub-choroidal hemorrhage.

It seems improbable that reattachment of the retina after the severe attack of glaucoma was merely coincidental. I am inclined to believe that there was a causal connection between the two events. However, I admit that I am not able to give a fully satisfactory explanation of the mechanism involved. If two fluids of different molecular concentration are separated by a semipermeable membrane, the difference of osmotic pressure on the two sides of the membrane produces a tendency to equalize the concentration in both fluids. If the molecular concentration in the fluid behind a detached retina is lower than in the vitreous fluid an exchange of fluid from the subretinal space into the vitreous space is theoretically possible, diminishing the volume in the subretinal space and increasing the volume in the vitreous space. The result would be a relative approach of the retina to the original position. This principle was applied when in the preoperative era

hypertonic salt solutions were administered subconjunctivally, the sclera serving as a semipermeable membrane. It was, however, not generally recognized that the effect of the injection of hypertonic solutions outside the sclera was attributable to their hygroscopic properties. Wesely<sup>9</sup> is of the opinion that the reactive hyperemia of the intraocular (choroidal) vessels plays a more important part in the process. That the production of an inflammatory process in the choroid is essential to the development of adhesions between the reattached retina and the choroid has become commonly accepted. Whether this is done with cauterizing chemicals or with the diathermic needle is of lesser importance. It is, however, generally agreed that in all cases of considerable elevation of the detached retina it is necessary to bring the retina into closer contact with the choroid by draining a considerable amount of subretinal fluid either before or during or immediately after the cauterizing procedure.

There seems to be no doubt that the subretinal fluid contains certain toxic substances that can cause severe irritation of the uveal tract. Birch-Hirschfeld<sup>10</sup> injected subretinal fluid, previously withdrawn with a syringe, into the vitreous body of the same eye and frequently observed a reactive iridocyclitis such as never occurred when a neutral isotonic solution was injected. In untreated cases we fairly often see develop a more or less severe uveitis that is usually attributed to the toxic reaction of the subretinal fluid itself. Whether the secondary cataracts often observed in cases of retinal detachment of long standing are caused directly by that toxicity or result from the chronic uveitis is still an open question. At any rate the fact that the subretinal fluid contains substances capable of producing inflammation seems to be well established.

Deutschmann<sup>4</sup> believed that the thera-

peutic result obtained by injecting rabbit vitreous into the human vitreous body was entirely caused by the process of swelling of the foreign material and that the resulting expansion in the vitreous body pressed the retina back into place. Generally speaking, the good results obtained with the modern methods seem to indicate that our main objective must be drainage of the subretinal fluid and occlusion of the retinal hole or holes, and the combination of these two processes with a reactive inflammation in the eye serves to produce solid adhesions between the retina and the choroid.

Concerning the case here reported, all explanations of the favorable end result rest, I admit, on mere conjecture, since I am in the dark in respect to a number of facts. Entirely unknown is the cause of the first blindness suffered in the patient's left eye in connection (as he thinks) with the abdominal operation in 1925. Whether he had a first retinal detachment at that time is mere guess-work, since the eye was not examined. It is even not impossible that the left eye had been practically blind for sometime without the patient's realizing it and that he detected the visual defect accidentally upon covering his right eye. It is fairly safe to assume that the detachment in the winter of 1942 and 1943 was a direct result of the preceding cataract operation. The anterior synechiae of the pillars of the iris coloboma, the subsequent ingrowth of epithelium into the anterior chamber, and the contours of the scar of incision at the limbus seem to indicate that the operation had been somewhat complicated. It is not exactly known how long after the operation the detachment took place, but probably at least several weeks later.

A hole was not found in the retina, but this does not mean that there had been no hole. A mild chronic uveitis probably had persisted for a number of months

and was still present when I saw the patient first, about  $7\frac{1}{2}$  months after the cataract had been removed. The eye was very hypotonic. Not quite three weeks later a glaucomatous attack of short duration occurred. The tension became normal within 36 or 48 hours and has remained normal ever since. The exact time when the retina became reattached cannot be determined. The total reattachment was found  $2\frac{1}{2}$  months after the attack of glaucoma. If there was a causal connection between the two events it must be assumed that during the short attack of glaucoma that followed extreme hypotony the intraocular pressure in the vitreous body squeezed out the subretinal fluid through some kind of leak and pressed the retina against the wall of the globe. There it was retained by adhesions arising from the inflammatory uveal process, which probably was also responsible for the hypotony found in that eye at the time of my first examination. However, I was not successful in finding such a leak. Nor does the assumption of the presence of a retinal hole afford any help. An open hole in the membrane separating one fluid from the other would represent a communication between the two fluids and would allow free exchange from one side of the membrane to the other, according to common hydrostatic laws. It has been supposed by Leber<sup>2</sup> and others that a flap of retinal tissue sometimes serves as an operculum or valve permitting fluid to escape in one direction—that is, from the subretinal space into the vitreous—but not in the opposite direction. However, the existence of such a mechanism has not been positively proved. The only fairly plausible explanation that remains is a difference in viscosity between the subretinal and the vitreous fluids. The less viscous subretinal fluid may have been allowed to escape through lymph spaces (or by absorption?), the

very sudden rise of intraocular pressure serving as a *vis a tergo*. An acute swelling of the vitreous body as a whole could probably produce a *vis a tergo*. That thereupon the reattachment did not at once manifest itself subjectively is quite understandable, since the retina required some time for functional recovery. That the retina stayed in place is likewise imaginable, since the mild uveitis persisted for a while after the attack of glaucoma, at least for a sufficient length of time to produce the necessary adhesions. After having accomplished that task the inflammation gradually faded away, since the irritant agent formed in the subretinal fluid had disappeared. Normal exchange of intraocular fluid, and with it normal tension, was then established. Nevertheless it is surprising that the function of the retina returned practically to normal after a lapse of at least five or six months during which the retina lacked the necessary contact with the pigment epithelium and choroid. Whether the condition will

be permanent or only temporary is another question which has little to do with the problem of causation. At the present time (December 14, 1943) at least the left eye is still behaving like a normal aphakic eye.

#### SUMMARY

Total detachment of the retina in an eye of a man of 80 years followed intracapsular extraction of a hypermature cataract. The detachment persisted for several months, the eye being practically blind for that period. The eye contracted an acute attack of glaucoma of short duration, and subsequently the retina became completely reattached with full restoration of function including visual field. A causal connection between the occurrence of the glaucoma following a severe hypotension, on the one hand, and the subsequent reattachment, on the other, is assumed.

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# NOTES, CASES, INSTRUMENTS

## MOTILITY CLINIC

### PARESIS OF THE RIGHT SUPERIOR RECTUS MUSCLE\*

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Miss J. C., aged 20 years, was first seen 6 months ago. Her history gave no background of ocular disease or anomaly in the family. She herself had never been seriously ill; her mother, however, had noticed that from babyhood the patient's eyes had a tendency to turn out, particularly when she was tired. She had not been troubled much with her eyes nor had she ever worn glasses. Close work brought on eye fatigue which had become pronounced in the past year, during which the patient had done exacting close work. If, in spite of the ocular fatigue, she persisted in such work she would develop severe frontal headaches. Her physician had advised her to give up this work, but loath to relinquish it, the patient had come for consultation and possible treatment.

Visual acuity uncorrected was 20/15 in each eye. Refraction was: R.E. +0.50D. cyl. ax. 180°; L.E. +0.50D. sph. External examination and examination with slitlamp and ophthalmoscope disclosed no pathologic changes.

### DIAGNOSIS

*Neuromuscular examination.* Inspection revealed nothing abnormal except a somewhat larger lid fissure on the right side. Movements of the eyes were free in all directions save one. No excess nor deficiency of the rotations was present *except* when the patient looked *up and to*

*the right*; then the right eye appeared to lag behind the left.

This behavior would indicate the presence of a paretic condition in the right eye, suggesting a *weakness of the right superior rectus muscle*, for that muscle has its maximum elevatory effect in an abducted position of the eyeball.

*Cover test* (prism and cover test or screening test). The patient was seated before the tangent screen in the middle of which was a small light, which she was asked to fixate. There was no deviation; the patient, therefore, had binocular fixation.

Fusion was now interrupted by covering one eye for a few moments to see whether any appreciable movement occurred after the cover was removed and the eye resumed fixation. Upon removing the covering from the right eye a marked *inward* and slight but noticeable *upward movement* of that eye occurred. The test was repeated on the left eye, whereupon an *inward* and *downward* movement of that eye was apparent.

In the primary position of the eyes, the patient had thus been found to have an exophoria and a left hyperphoria. In order to measure the magnitude of the heterophoria, loose prisms, base out, and loose prisms, base up, were placed in front of the right eye. Base in 20<sup>A</sup> and base up 8<sup>A</sup> were required to offset the movement in the cover test.

Next the *double-image test* was performed by placing a dark-red filter first in front of the patient's right eye. The filter excluded everything from the field of vision of that eye except the light in the center of the tangent screen, which appeared red. The left eye continued to fixate the white light. The patient at once indicated the presence of diplopia. She saw the white light in the center of the screen, the

\*From the Clinical Division of the Dartmouth Eye Institute, Dartmouth Medical School. The case described was demonstrated at a staff meeting of the Dartmouth Eye Institute.

red light to the *left* and *above* the fixation light; from her statement it appeared that the distances were 10 arc degrees in the horizontal and 4 arc degrees in the vertical direction. Crossed diplopia indicated exophoria; vertical diplopia above the horizontal plane with the right eye covered indicated left hyperphoria; the figures obtained in the subjective measurement of the diplopia coincided with those resulting from the cover test and it could be assumed that the patient had *normal retinal correspondence*. The cumbersome screening test in the secondary and tertiary positions of gaze could therefore be omitted and the much simpler double-image test used.

The red glass was kept in front of her right eye and the patient was asked to keep fixating the light while her head was turned to the left, the right, down, up, down and left, down and right, up and left, and up and right, and to report in each of these positions of the head the position of the red double image. The result follows:

to the right and up; it decreased when she looked up, to the left, and particularly when she looked to the left and up. In the whole lower field of fixation there was an equal amount of left hyperphoria which was somewhat smaller than in the primary position.

At first glance these findings did not seem to be characteristic of a paresis of a particular muscle, but experience was called upon to help in their interpretation. It will be recalled that on inspection the right eye seemed to lag in moving up and to the right. This is the direction in which the right superior rectus acts most strongly as an elevator, and a weakness of that muscle would be suspected. From the double-image test it was learned that the vertical separation of the double images—that is, the vertical separation of the eyes—was indeed larger when the patient looked up and to the right than it was in the primary position. But the separation of the double images was just as great when the patient looked to the right in the horizontal plane, and an in-

	Up and Right	Up	Up and Left	
Right	15° Exo 6-7° LH	10° Exo ½° LH	4° Exo No H	Left
	10° Exo 6-7° LH	10° Exo 4° LH	4° Exo ½° LH	
	4° Exo 3° LH	6° Exo 3° LH	3° Exo 3° LH	
	Down and Right	Down	Down and Left	

In the table recording the patient's answers, the findings in the primary position of the eyes are blocked out by heavier lines: the notations indicating the secondary and tertiary positions denote the direction of the gaze; the amount of deviation is indicated in arc degrees.

Beginning with the hyperphoria, an analysis of the figures indicated that there was a left hyperphoria which increased when the patient looked to the right and

crease in the vertical separation of the double images would certainly be expected when the patient looked up, if an elevator muscle were involved. Instead, there was a decrease in the separation of the double images. Furthermore, this separation was not much smaller in the lower field of fixation than in the primary position, a factor which also would seem to argue against the affection of an elevator muscle.

In view of these findings, could a paresis of the right superior rectus muscle still be considered? In answering this question it was to be remembered that the imbalance had not been a recent one, but was inveterate, probably congenital. Hence it was not to be expected that evidence of a recent superior-rectus paralysis would be found in a patient who had had this condition for 20 years. During this period a twofold healing process had taken place: one, the improvement of the action of the affected muscle; the other, a secondary contraction of the antagonist. Both processes tend to transform the paralytic deviation into a concomitant one.

An analysis of the hyperphoria from this point of view will bring about a better understanding of the values uncovered in the several tests: The left hyperphoria in the lower field of fixation is to be explained by the contraction of the antagonist; the left hyperphoria in the right upper quadrant was due to the residue of the paresis of the superior rectus which was naturally most marked in that direction; the left hyperphoria in the primary position and in dextroversion could be explained on the basis of a cumulative effect of both components. The fact that there was no hyperphoria in the left upper quadrant was a most convincing indication that the right superior rectus was at fault.

Turning now to the behavior of the exophoria as a possible source of help in solving the problem, it must be remembered that the superior rectus acts not only as an elevator but also as an adductor. If its function is weakened a certain amount of exophoria may be expected. However, the adductive function of the superior-rectus muscle is a secondary one, and the resulting exophoria would increase algebraically the horizontal phoria which the patient had prior

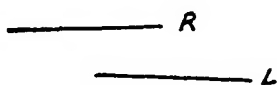
to the paralysis. It is therefore impossible to diagnose a superior-rectus paralysis—or that of any vertical motor—from the behavior of the horizontal phoria alone, but the latter may be a helpful diagnostic adjunct.

In this patient the exophoria decreased in the lower field of fixation. This is a physiologic occurrence—exophoria decreases normally in looking down and increases in looking up. This patient also showed an increase in looking up, but only in looking up and right. In the upper left field of fixation—and, indeed, in the whole left half of the field—the exophoria decreased markedly; and this is not physiologic. It is quite probable that a good deal of the exophoria was a result of weakened action of the superior rectus, and the behavior of the exophoria supported the theory of a paresis of the right superior rectus.

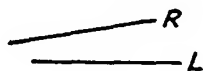
In addition to its action as an adductor, certain other secondary functions of the superior rectus muscle remained to be investigated. One was its torsional action. The superior rectus is an intorter; that is, its isolated contraction would induce an inward rotation of the upper pole of the eyeball. In contradistinction to its function as an elevator, the torsional action is greatest in adduction. If the action of the superior rectus muscle is weakened, an *outward* torsion of the eyeball results, and the double images of a horizontal line will not appear parallel but convergent. The *tipping* of the double image pertaining to the eye with a paretic vertical muscle is always *in the direction in which an isolated contraction of that muscle would rotate the horizontal meridian of the eyeball*. In the case of a right superior-rectus paresis, the double image of a horizontal line pertaining to the right eye should be tipped down at the left; it would appear to converge at the left toward the double image of the horizontal line, per-

taining to the left eye.

In this respect the patient's eyes behaved as follows: In the primary position the patient had single binocular vision; but when her head was turned so that she looked up and to the right toward a horizontal strip on the wall, she saw the strip double. She stated that one strip was considerably higher than the other and shifted to the left, and that the two strips were a little closer together on the left side. Upon covering her right eye it was found that the upper image belonged to the right eye. What she saw appeared somewhat like this:



The patient's head was turned now so that she looked up and to the left; whereupon she saw the two double images very much closer together, but the upper image tipped much more than before:



This behavior of the double images of a vertical line definitely confirmed the diagnosis of a right superior-rectus paresis. Even when a paresis has become largely concomitant, the characteristic tipping of the double images of a horizontal line can always be uncovered.

Finally, the effect on the vertical deviation of tilting of the head toward the shoulders was to be observed. When her head was tilted toward the left shoulder while the patient fixated the light on the tangent scale, there was little if any vertical deviation of the eye, even if fusion was interrupted by occluding one eye. But when her head was tilted to the right shoulder, a vertical divergence immediately became noticeable. This action again conforms with the conditions in a

paresis of the right superior rectus muscle. The right superior rectus is a levotorter; that is, it coöperates synergistically with the other levotorters in straightening the vertical meridians of the eyes when the head is tilted toward the right. Since its action in that position was absent, the equilibrium of the levotorters was upset and a hypertropia resulted. In tilting the head to the left shoulder the levotorters are not called into action and there was no hypertropia.

#### THERAPY

The diagnosis of *inveterate paresis of the right superior rectus muscle* having been established, the question of therapy arose. Resection of the superior rectus appeared to be the best and only course to pursue. The paresis was not marked, and a good functional result could be expected. On the whole, an operation on the superior rectus has its complications. Its fascial connections with the levator generally cause a narrowing of the lid fissure after resection or an enlargement after recession. In this particular case, however, and for reasons that were not apparent, the lid fissure was slightly wider on the right side, whereas, as a rule, it is narrower when there is a weakness of the superior rectus. It was therefore believed that a careful resection might be performed in the expectation of achieving even good cosmetic results.

The operation was accomplished without incident, and the immediate post-operative result showed the desired over-effect. The day after the operation there was, in the primary position, a right hyperphoria of 5 to 6 arc degrees with 8 to 10 arc degrees of exophoria, which amounted to an immediate postoperative effect of 9 to 10 arc degrees. In the whole field of fixation there was a right hyperphoria which increased, as was to be ex-



pected, in looking up and right, where it was as much as 8 arc degrees. —about 8<sup>d</sup>—but no hyperphoria. As to the double-image test, the results are

The overeffect decreased rapidly, and tabulated as follows:

Up and Left		Up	Up and Right	Right
Left	2° Exo No H	Orthophoria	Orthophoria	
	2-4° Exo No H	4° Exo ½° RH	2-4° Exo No H	
	Orthophoria	Orthophoria, at times sl. Esophoria	1° Exo No H	
Down and Left		Down	Down and Right	Right

10 days after the operation the patient showed, in the primary position, only 2 arc degrees of right hyperphoria with 4 to 5 arc degrees of exophoria. One month after the operation the right hyperphoria in the primary position had completely disappeared and was only slightly evident in elevated and abducted positions of the eye. The exophoria was also considerably reduced.

Five months after operation the patient reported that she had gained 10 pounds since the operation, that she had never felt better, and that she could engage in any amount of close work without the slightest discomfort. It was now, in her opinion, "fun to study."

The lid fissures are now equal in width, and the patient has binocular fixation for distance. The *cover test* disclosed that when the eyes had been dissociated for a considerable length of time there was a certain amount of exophoria

These findings show that the vertical-muscle imbalance has entirely disappeared; in addition, and this is interesting, about two thirds of the exophoria has also disappeared. This confirms the original assumption that the patient's exophoria was at least in part due to the weakness of the superior rectus. There is no longer a diplopia in any part of the field of fixation, and therefore the rotational behavior of the horizontal double images cannot be tested. There is no difference in the position of the eyes in the head-tilting test. Stereopsis, tested with the graduated Keystone DB6 chart, was found to be 100 percent.

An ideal operative result, such as was achieved in this patient, cannot be expected to ensue in every case. This case is discussed mainly to show that the operative result confirmed the preoperative diagnosis of a weakness of the right superior rectus muscle.

# SOCIETY PROCEEDINGS

EDITED BY DR. DONALD J. LYLE

## COLLEGE OF PHYSICIANS OF PHILADELPHIA

### SECTION ON OPHTHALMOLOGY

February 18, 1943

DR. ALFRED COWAN, *chairman*

#### MALIGNANT EXOPHTHALMOS

DR. A. S. CRANDALL reported the case of a white man, 48 years old, who developed increasing exophthalmos beginning one month after undergoing thyroidectomy for Graves's disease. Proptosis increased to such an extent that exposure keratitis was imminent, and visual acuity dropped to 20/400 in each eye. A Naffziger operation was done on one side and a Shugrue operation on the other side, but without benefit. He was also given desiccated thyroid and stilbestrol, without benefit. He improved markedly following pituitary irradiation.

The second case was of a white man, aged 33 years, who developed progressive exophthalmos seven months after thyroidectomy for diffuse toxic goiter. Following treatment with desiccated thyroid, stilbestrol, and pituitary irradiation, the exophthalmos remained stationary, conjunctival edema cleared, and vision improved.

The third case was observed in a colored woman, aged 45 years, who had an exophthalmic goiter and developed rapidly increasing exophthalmos and decreasing vision. After treatment with potassium iodide, stilbestrol, and pituitary irradiation, the exophthalmos remained stationary and vision improved.

Malignant exophthalmos has been shown to be due to edema of the orbital tissues. The edema was caused by a hormone from the anterior lobe of the pituitary gland. Sex was another factor. Good

results were reported by treating with roentgen irradiation of the pituitary gland and orbits combined with the administration of desiccated thyroid and estrogenic substances.

*Discussion.* Dr. E. Rose said the term "malignant exophthalmos" implied the possibility that some malignant process was responsible for the exophthalmos; whereas such was usually not the case. "Progressive exophthalmos" would be a better term.

Ginsberg, in 1939, cited 45 different writers who had advanced theories—some of them duplicating others—in an effort to explain exophthalmos. Some of those theories were fantastic and extremely bizarre: the result of an excessive amount of vitreous; excessive deposits of retrobulbar fat; extreme congestion of the vessels of the orbit; and variations in size of the sphenoidal fissure.

One of the most prominent theories, apparently for a number of years, was the one involving hypertonus of the muscle of Müller. This received support from the fact that in certain experimental animals it was possible, with considerable regularity, to produce exophthalmos by stimulation of the cervical sympathetics; and it was shown a number of years ago by McCallum and Dandy at Johns Hopkins that stimulation of the cervical sympathetics no longer produced protrusion of the eyeball in dogs whose Müllerian muscles were transversely cut.

However, the muscular fibers in the Müllerian muscle in man were not nearly so well developed as they were in some of the lower animals, such as the dog; and the results of an experiment by Friedgood and Cattell, in Boston, tended further to disprove the theory that the cervical sym-

pathetics had anything to do with exophthalmos. They stimulated the cervical sympathetics in 9 or 10 patients who were having thyroidectomies for hyperthyroidism, while the neck was open on the operating table. In only one of these patients were they able to demonstrate any protrusion of the eyeball (1 to 2 mm.). In the other seven or eight individuals with hyperthyroidism but without exophthalmos, they were unable to produce any demonstrable increase in the prominence of the eye by stimulating the cervical-sympathetic ganglion. Not all patients lost their exophthalmos after subtotal thyroidectomy.

Soley in San Francisco, and Galli-Menini at the Massachusetts Hospital, in measuring the exophthalmos of a group of patients before and after thyroidectomy, found that very few of these individuals actually showed a regression of the exophthalmos: it either remained the same or got worse. The deceiving factor seemed to be the loss of the increased tone of the muscles of the upper lid, which often caused disappearance of the retraction of the upper lid after thyroidectomy, and thus gave the false impression that the exophthalmos had receded; whereas careful measurements did not bear this out.

In this type of exophthalmos, the offending organ seemed to be the pituitary rather than the thyroid; and probably the anterior part of the pituitary in some way not yet fully understood, produced a something, a secretion or a factor, which seemed to have this ophthalmotropic effect which Dr. Crandall mentioned. This produced the changes in the retrobulbar tissues of the orbit which, combined with the relaxed tension of the extraocular muscles, resulted in forward propulsion of the eyeball.

This process could stop spontaneously at any point. Friedgood, who had written

one of the best reviews of the entire subject, believed that this exophthalmic process could be divided into a reversible and irreversible stage. The reversible stage was that stage in which the protrusion of the eyeball was the result of edema of the retrobulbar structure. If that edema subsided, the eyeball receded into the orbit; thus explaining the fact that many patients with exophthalmos who die lose their exophthalmos soon after death. They probably had edema which disappeared after death. In life, after a certain length of time this edema was replaced by round-cell infiltration, producing a brawny induration of the structures; then the exophthalmos had reached the irreversible stage.

They must be very cautious in their interpretation of the results of treatment. So few cases had been treated by the means outlined by Dr. Crandall that they had insufficient data upon which to base any valid conclusion. Medical treatment was still based largely on theory. They irradiate the pituitary on the assumption that it was responsible. They did not know how effective that irradiation was. Next, they sometimes gave desiccated thyroid with the thought that the thyroid would have some inhibitory effect on the anterior pituitary. That again was theoretical endocrine medicine, which might not have sufficient basis in fact. They also gave estrogenic substances, either natural or stilbestrol, because there was experimental evidence to suggest that estrogenic substances had an inhibitory function on the anterior pituitary. Again, they were working on a basis of theory. So he thought they must be very cautious in their interpretation of pituitary results, especially since they know it can stop at almost any given point.

Speaking as an internist interested in endocrine medicine, he agreed with Dr. Crandall that one should approach with

extreme caution operative treatment in thyrotoxic patients in whom the exophthalmic syndrome dominated the thyrotoxic picture. In the face of severe or rapidly progressive exophthalmos, especially if associated with edema of the lids, with chemosis, with congestion of the conjunctiva, and particularly if the thyrotoxic picture be not very severe, they had learned to approach surgery with great caution. If such patients responded in an exaggerated fashion to the administration of iodine, one should be very cautious about employing surgery. It has been pointed out that instead of showing a gradual (10 to 14 days') drift down to normal in the basal rate, some of these patients with the mild thyrotoxicosis associated with severe exophthalmos would show a quick drop in the basal rate to substandard levels.

They might, under such circumstances, as in the third case reported by Dr. Crandall, depend upon iodides or a combination of iodides with X-ray treatment to the anterior pituitary and to the thyroid.

Thus they had learned from these cases a practical lesson in general medicine, and looked forward with interest to the future developments in this field.

Dr. F. H. Adler said that Dr. Crandall and Dr. Rose had shown that in these cases of progressive exophthalmos the proptosis at the beginning of the disease was out of all proportion to the thyrotoxic symptoms. It was extremely difficult for them to judge the degree of exophthalmos in any individual, since the normal readings, varying so much from one patient to another, depended on the physiognomy. Some people had more prominent eyeballs than others, and the only way they could tell in an individual case whether the degree of protrusion was abnormal was by a difference in the measurements of the two sides; or by noting a change in the measurements over a period of time. It

has been their experience that these cases show very little evidence of thyrotoxicosis, judged by tachycardia, sweating, tremor, and loss of weight.

Dr. W. E. Fry said that in the first case reported by Dr. Crandall, a Naffziger operation was done on one side and a Shugrue on the other. It had not been the intention in dealing with this patient to obtain a comparison between the effects of the two operations. The Naffziger was done first, and due to technical difficulties it was not possible to complete the operation on the other side. Because of that, another type of operation was decided upon, and the Shugrue was done.

From the measurements, about the same amount of decrease in exophthalmos was obtained with each of the operations, about 2 mm. As could be seen from the figures, the amount of decrease in exophthalmos was much greater under the X-ray and therapeutic treatment.

#### VOGT-KOYANAGI SYNDROME

DR. H. ABRAMS, inspired by the excellent report of Carasquillo in 1942, presented two patients with features of the Vogt-Koyanagi syndrome.

The first patient was a Negro school boy, aged 16 years, who was seen at the Wills Hospital, on January 6, 1943, complaining of pain in the left eye and poor vision. There was no family history of any eye disease or pigmentary changes of the skin or hair. During childhood he had had measles, chicken pox, and mumps, with no complications. In January, 1941, a patch of vitiligo was noted on the right cheek and it gradually spread over the face to involve the right side of the nose and the region of the inner canthus. When the vitiligo reached the lid margins, poliosis was noted. The patient denied any hearing difficulties or tinnitus.

Physical examination revealed a thin male Negro in good general health. An

area of vitiligo was present on the right side of the face, involving a portion of the cheek, the side of the nose, and the inner-canthus region. The inner one third of the upper and lower lids had patches of vitiligo and contained pure white cilia. Visual acuity on admission was: R.E. 6/5; L.E. 6/60 (Snellen). There was moderate circumcorneal injection; numerous deposits on Descemet's membrane; many floating, vitreous opacities, and marked retinal edema, especially surrounding the disc. The macular area could not be clearly demarcated. One month later, visual acuity was unchanged. Examination with the biomicroscope revealed many old pigment granules on the posterior surface of the cornea, with some endothelial disturbance between the granules. No cells were noted in the deep anterior chamber. There were some areas of pigment on the anterior capsule of the lens along the pupillary border. The urinalysis, blood chemistry, blood Wassermann, and Mantoux-tests were negative.

The second patient was a white laborer, aged 21 years, who complained of failing vision and pain in the right eye. Three weeks after the onset of pain the eye became red and irritable; photophobia and lacrimation were constant. One week later, he noticed the cilia of the inner half of the right upper lid had turned white, and they subsequently fell out. Tinnitus was present for a short time.

Examination revealed a well-nourished, nervous type of individual. Visual acuity when first seen was: R.E. 6/12 with and without glasses; L.E. 6/12 without and 6/9 with glasses. There was a patch of vitiligo on the skin of the upper right lid at the lid margin, and finely pointed white cilia at the margin of the inner half of the right upper lid. Ocular examination revealed a phlyctenularlike keratoconjunctivitis, accompanied by an anterior uveitis,

corroborated by examination with the biomicroscope. When the uveitis had quieted down and most of the white lashes had fallen out, the visual acuity was: R.E. 6/12, improved to 6/9+3 with correction; L.E. 6/12, improved to 6/9 with correction. The only residual manifestations were vitreous opacities and fine pigmentary deposits on the anterior lens capsule, in addition to the white cilia and area of vitiligo.

He believed that since these patients manifested the same symptoms, that is, uveitis with poliosis, vitiligo, alopecia, and dyscousia, as reported by Carasquillo, although to a milder degree and unilaterally, they should be classified in the group of the Vogt-Koyanagi syndrome.

*Discussion.* Dr. A. Cowan remarked that this syndrome was first described by Vogt. Later, a number of cases that had already been reported were collected and, with about six cases of his own, were reported by Koyanagi. It seemed awkward to have to say uveitis with vitiligo, deafness, and alopecia. So that probably, since Vogt was the first one to describe the syndrome, there might be some justification in naming it "Vogt's syndrome," but he would like to ask Dr. Abrams why he had added the name of Koyanagi.

#### PAPILLEDEMA IN ACUTE DISSEMINATED LUPUS ERYTHEMATOSUS

DR. W. H. STEELE gave a brief outline of the pathologic picture of acute disseminated lupus erythematosus, and also presented an outline of the fundus lesions found in association with this disease. The following case was presented: A white woman, aged 20 years, was admitted to the hospital on January 3, 1943. Two months previously, following a cold, she had been admitted to another hospital with a diagnosis of facial erysipelas. A course of sulfonamides was started and after a few weeks the patient was dis-

charged. Immediately after discharge there developed a succession of fleeting joint pains, malaise, and dyspnea. Temperature on admission was 104°F.; blood pressure 100/60. Physical examination showed a red-brown indurated skin lesion in a "butterfly area" of the face; signs of consolidation at the bases of both lungs, and enlarged heart with friction rub. The patient gradually developed pericardial, pleural, and peritoneal effusions, with hepatomegaly, respiratory embarrassment, and periods of semiconsciousness. Neurologic examination was normal. A lumbar puncture on two occasions showed increased cerebrospinal fluid pressure.

Ophthalmologic examination showed mild conjunctival injection. Examination of the fundus of the right eye showed blurred disc margins, hyperemic discs elevated 4 diopters, moderate peripapillary edema obscuring vessels and containing many large, white, fluffy exudates with flame-shaped hemorrhages and dilated veins. The fundus of the left eye was similar to that of the right. Frequent examination failed to show any change in the fundus picture. The patient died 10 days following admission.

*Discussion.* Dr. W. E. Fry stated that his interest during the last few years had been in observing the variety of cases that presented a papilledema as an important ocular feature, and he thought this was one that could be added to the list. The papilledema was definite. It measured 4 to 5 diopters, and associated with it was an increased spinal-fluid pressure. That, to him, was the interesting feature of this case, although there were others that would be interesting from another point of view.

#### MALIGNANT MELANOMA OF THE CHOROID

DR. G. M. JOHNSON reported the case of a white truck driver, aged 42 years, who entered the Wills Hospital clinic on

June 20, 1942, complaining of a painful red left eye. He gave a vague history of pain in the left eye one year before but no history of halos. A week before he had pain in the left eye which kept him awake at night. He had some teeth extracted on June 15th and following this he claimed that the left eye had become more painful. The family history was noncontributory.

Examination of the right eye showed a moderately shallow anterior chamber, otherwise normal. In the left eye the conjunctiva was chemotic and markedly red. The cornea was slightly hazy, the anterior chamber obliterated, the iris atrophic and bulging forward. The pupil was fixed, measured 4 mm., and cast a greenish reflex. The lens was hazy and the vitreous was obscured. Marked photophobia was present. The vision in the right eye was corrected to 6/6; the vision in the left eye was perception of hand movements at 12 inches, and the light projection was good. The tension in the right eye was 17 mm. Hg (Schiötz) and in the left eye 66 mm. Hg. The diagnosis was acute congestive glaucoma.

On June 22d an Elliot trephining was done. The following day the conjunctiva was chemotic and red, and the tension was very high to palpation. On June 24th there was less chemosis, but the anterior chamber was shallow and the eyeball was hard as a rock. On June 27th a Frost Lang enucleation was performed. The recovery was uneventful.

Pathologic diagnosis was malignant melanoma of the choroid, spindle cell type B, glaucoma stage; choroidal, subchoroidal, and subretinal hemorrhage with detached choroid and retina.

The case was presented because it was so typical. The sudden onset of unilateral hypertension unrelieved by glaucoma surgery, with atypical visual fields, suggested neoplasm.

*Discussion.* Dr. E. B. Spaeth commented that apparently he had difficulty in learning some things, because this was the third time that the same situation had happened to him; that is, wherein the patient had been admitted with an acute inflammatory glaucoma and the underlying malignancy was undiagnosed.

The first of the three was an acute unilateral congestive glaucoma of high degree in an eye which was operated on by an iridectomy shortly after the patient's admission. The following day the tension was just as high as it had been the day before. For some unknown reason he presumed that it was a case of hemorrhagic glaucoma. An enucleation was done and an undiagnosed malignancy was found.

The second instance was in a man considerably older than the first of the two, who was admitted with an acute congestive glaucoma, and who was treated conservatively for one or two days. An iridectomy was done under general anesthesia. The cornea cleared up, in that instance, at the time of the operation, but the tension did not recede. It was perfectly remarkable to place a spatula upon the eye and find it as hard as it had been before the anterior chamber was opened. The patient had the barest of light reflexes in the superior nasal portion of the fundus. They thought in this case also there was a huge subchoroidal hemorrhage. The next morning the eye was enucleated and an undiagnosed malignant melanoma was discovered.

The third case was rather classical except that the eye was a bit more congested than was the case in the other two patients. It could be considered a sub-acute congestive glaucoma. The diagnosis of the malignant melanoma was not made until after the enucleation; the enucleation being done because the glaucoma did not respond to surgery.

These three cases emphasized one thing; namely, that unilateral glaucoma of high degree, in the absence of any pre-existing history, and regardless of the fields of vision found, can well be caused by an unsuspected intraocular malignant melanoma.

Dr. M. Blair said that he had had an experience similar to that of Dr. Spaeth, five cases in which malignant hypertension caused him to do, first, an iridectomy for the relief of pain, and, ultimately, an enucleation because the iridectomies made matters infinitely worse and subsequent biopsies revealed melanosarcoma of the choroid. The eye in one of the five cases in particular developed metastatic sarcoma of the liver and the patient lived less than five months from the date of the enucleation of the eye.

The difficulty they had is that they get these cases too late. An early diagnosis would mean earlier enucleation and less danger of metastasis; also less embarrassment for the surgeon, who could determine the nature of the situation by transillumination.

#### GLASS-BLOWERS' CATARACT

DR. G. J. DUBLIN reported glass-blowers' cataract as a rare condition, particularly at the present time when glass manufacturing is done almost exclusively by machinery. The condition might also be present where excessive heat was used in processing metals, as noted in sheet millmen, tin-plate workers, blacksmiths, and so forth. The etiology of the condition had been claimed to be physical, as heat or excessive sweating, which precipitates some aqueous substances; or by infrared- and ultraviolet-ray light. A textbook description of this entity was recounted, setting forth the period of onset and the frequent association with senile cataract in its early stages, particularly in that this latter complication would mask



the early symptoms of glass-blowers' cataract.

A differential diagnosis of glass-blowers' cataract from senile saucer-shaped, complicated, and traumatic confusion cataract was given. A detailed description of the case of a glass blower, aged 82 years, with bilateral involvement was offered. Particular attention was called to the fact that the most pathognomonic finding of this condition was lamella separation. Three types of this separation were noted and a description of each with the various diseases with which each was associated was given.

*Discussion.* Dr. A. Cowan said that Dr. Dublin's case was the first he had ever seen in a glass blower. He had seen one in a puddler, one in a laborer, and another in a carpenter. He agreed with Dr. Dublin; he could not see how anyone could diagnose the onset of glass-blowers' cataract by the signs similar to the ordinary types of cataract. If they studied these cases, it seemed to him that it was obvious that the anterior zonular lamella did cover the entire anterior surface of the lens. In capsular, cuticular cases, erosion evidently started behind the iris, and in most of them the central portion remained intact, while in the glass-blowers' type, the separated zonular lamella remained a homogeneous, transparent, more or less intact membrane.

He had never seen a place that would indicate a break, and it always seemed that if the separated membrane were extended it would go down below the lower border of the pupil. The break must take place out near the equator of the lens. In one, the anterior zonular lamella was eroded, whereas in the other there was a separation of a more or less intact zonular lamella. It was probable that heat, while it might be a factor, was not the whole cause of this condition.

Dr. M. Blair thought that something

constructive might be done by using Shahan's electro-thermophore experimentally on the cornea of animals, recording the effects of the traumatism of heat of varying intensities and varying lengths of exposure to such temperatures. Or, even better, to duplicate the actual conditions that men work in, as far as the workers before white heats were concerned. These men, even though presumably protected by cobalt glasses, formed a very large percentage of those afflicted with cataract, and he could hardly be convinced that glass blowers could escape the results of similar exposure, especially if the exposure were continued over many years.

Dr. I. Tassman stated that the question arises as to how much indirect traumatism entered into the production of cataracts. In these cases, Dr. Dublin implied that the cataracts were not typical and might also occur among people who were engaged in other occupations, as well as among glass blowers, furnace workers, and others. Would not indirect traumatism play some part in the production of this particular type of cataract? He did not know how much blowing a glass blower must do today, but in years past, they probably did a great deal, which might have caused considerable increase in the pressure and distension within the eyeball, and led to an indirect traumatism to the lens. He did not believe the question of heat in its relation to the production of cataract had ever been definitely settled. He thought that some years ago it was shown by actual experiment that the temperature in the neighborhood of the crystalline lens was not increased as the result of exposure of the eyes to extremes of heat, most of which was absorbed by the iris acting as a screen. There must be another important factor that was concerned in the production of these cataracts.

Warren S. Reese,  
*Secretary.*

# COLORADO OPHTHALMOLOGICAL SOCIETY

February 20, 1943

DR. JAMES M. SHIELDS, *presiding*

## PIGMENTED NEVUS

DR. WILLIAM M. BANE presented the case of L. S., a 21-year-old student nurse, who had come to the Out-Patient Clinic of the Medical School. She stated that seven years ago her attention was called to a brown spot at the outer edge of the cornea of her left eye which extended onto the white of the eye. This spot had not been noticed previously. Since that time it had not grown larger nor had it changed in appearance. She experienced no discomfort. The vision was normal in each eye with and without glasses.

The appearance was that of a flat pigmented nevus at the outer limbus, with irregularly shaped dots of pigment scattered throughout the superficial layers. There were pigment spots in the adjacent cornea also. The case had become of interest from the standpoint of treatment. The patient wished to have the spot removed and the question arose as to whether it would be safer to leave it unmolested or to excise it. In either case the possibility of its developing into a malignant nevus had to be seriously considered.

## UNUSUAL CHANGE IN REFRACTION

DR. WILLIAM M. BANE reported a case of unusual change in refraction which occurred between June 1, 1942, and February 19, 1943, when the last examination was made. The changes consisted of fluctuation in the apparent hyperopia in the right eye only, the amount of hyperopia in the left eye remaining unchanged. The patient was a 66-year-old woman. On June 1, 1942, the following prescription was ordered: R.E. +0.75D. sph.  $\approx$  +0.25D. cyl. ax. 180°; L.E. +0.75D.

sph.  $\approx$  +0.12D. cyl. ax. 175°. The vision was 5/4 in each eye with these glasses. Examination of the eyes showed no structural abnormalities.

On October 13, 1942, the patient stated that the vision in the right eye had been blurred for six weeks. The findings were: R.E. +1.50D. sph.  $\approx$  +1.00D. cyl. ax. 5°, vision 5/5. A thorough physical examination was negative.

On October 22, 1942, refraction was R.E. +2.25D. sph.  $\approx$  +1.00D. cyl. ax. 30°, vision 5/5-2. On November 5, 1942, refractive error was R.E. +4.50D. sph.  $\approx$  +0.50D. cyl. ax. 90°, vision 5/5+. Studies of the visual fields on the tangent screen showed no defect.

The findings on December 31, 1942, were R.E. +1.50D. sph.  $\approx$  +0.50D. cyl. ax. 180°, vision 5/5+. X-ray examination of her teeth revealed nothing abnormal. On February 19, 1943, refraction revealed R.E. +2.00D. sph.  $\approx$  +0.25D. cyl. ax. 170°, vision 5/7-2. There had been no change in the refraction of the left eye.

No pathologic change in the media or fundus had been observed at any time with the pupil dilated, except a floating shred seen at this examination. There must have been a cause for this unusual phenomenon, but up to the time of the last examination it had not been found.

## CONTRECOUP CONTUSIONAL FUNDUS INJURY

DR. R. W. DANIELSON presented the case of H. S., a 12-year-old boy, who had been struck in the right eye, one month previously, with a BB shot from an air gun. The shot had struck at the limbus, lacerating the conjunctiva and had produced a complete hyphemia. An X-ray picture was negative for shot either in the orbit or in the surrounding soft tissues. As the blood was absorbed from the anterior chamber a considerable amount of

blood was seen in the vitreous. When last seen, the blood had practically become absorbed, and a view of the fundus was obtained. There was a marked fibrotic stellate lesion in the macula, such as is frequently seen in contusional injury. The interesting additional feature was the finding of a profuse number of multi-sized irregular areas of pigment nasal to the disc. These also were undoubtedly due to the contusion. The vision was less than 20/200.

#### CONGENITAL REMAINS IN VITREOUS

DR. R. W. DANIELSON presented the case of a 38-year-old laborer whom he had had the opportunity to see only briefly. The man had complained that for the past two weeks his right eye had been slightly red and that he had noticed some floating spots. He stated that as late as 1940 he had qualified as an expert marksman with his right eye. At this time his vision was 20/60 in the right eye. Examination showed a faint opacity of the posterior capsule of the lens. To the nasal side in the vitreous was a round highly refractory yellowish-white disclike mass to which was connected some fibrous tissue. There did not seem to be any connection between the lens and the mass, nor the head of the optic nerve and the mass. An X-ray examination for radio-opaque foreign body was negative. It was concluded that this mass represented a congenital remains which in fetal life might possibly have been fastened to the posterior surface of the lens.

#### QUESTIONABLE RETINITIS PROLIFERANS

DR. JOSEPH TSCHETTER presented the case of M. W., aged 49 years, who came to the clinic because of blurred vision of the left eye of one year's duration.

Examination of the eyes showed that the vision was R.E. 20/20; L.E. 20/100. The vision was unimproved with lenses.

The tension in each eye was normal. Physical examination was negative. Fundus examination of the left eye showed a whitish, funnel-shaped area in the upper quadrant of the retina with many new-formed vessels extending outward into the vitreous.

Walter A. Omart,  
*Secretary.*

### LOS ANGELES SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

February 22, 1943

#### EPIBULBAR TUMORS

DR. HAROLD F. WHALMAN demonstrated by kodachrome slides a series of epibulbar tumors from the point of view of differential diagnosis and critical treatment. Emphasis was placed on melanoma and the epithelial growths, papilloma and epithelioma.

He referred to recent literature on melanosis of the conjunctiva, particularly the publication of Dr. A. B. Reese, pointing out that acquired melanoma usually had at least five years of premalignant existence before becoming sarcomatous. Hence the history of these cases was important and early removal of small melanomas desirable. Generalized melanosis was not amenable to treatment except exenteration, if the growth were increasing rapidly.

Dr. Whalman pointed out that papilloma might arise in small limbal hyperplasia or pterygia and could not be distinguished clinically from epithelioma except for the tendency to pedunculate. He stated that the cornea and sclera offered resistance to the penetration of epithelial cells, but there was nevertheless invasion to some extent in both instances. Both conditions were treated in the same manner; namely, by sharp excision followed by radiation with radium needle.

Radium penetration could be easily controlled to prevent injury to the lens and subsequent cataract formation and resulted in little scarring and corneal opacity. He felt that it was insufficient simply to excise the growth, for recurrences were common with papilloma and certain with epithelioma when irradiation was omitted. He said removal by cautery was acceptable and that the heat penetration was sufficient to destroy invading epithelial cells, but more scarring and opacity were likely to result.

*Discussion.* Dr. William A. Boyce said that in his experience cautery excision of the epithelioma had been satisfactory.

#### TUBERCULOUS UVEITIS

Dr. PAUL V. YINGLING (by invitation) gave a review of tuberculosis of the eye. He described all the well-known conditions and the present conception of treatment particularly with reference to tuberculin therapy.

*Discussion.* Dr. Harold F. Whalman referred to the recent publication of Dr. C. Alan Woods who found a high percentage of cases of chronic uveitis on a tuberculous basis.

Drs. Clarence Albaugh, Samuel Abraham, George Landegger, William A. Boyce, and others discussed the question of establishing tuberculous etiology.

In general, it was conceded that history, clinical appearance, chronicity, elimina-

tion of focal infection, complete laboratory studies for syphilis, undulant fever, and plasma, and a fair therapeutic test were all that were available to establish a diagnosis.

#### PRELIMINARY REPORT ON THE CLINICAL USE OF GRAMICIDIN

Dr. EUGENE CHRISTENSEN reviewed the status of the new agent gramicidin, its origin, and clinical application. He cited several instances of clinical trial in cases of conjunctivitis, emphasizing the recent epidemic keratoconjunctivitis, which cleared promptly with gramicidin and did not run its usual protracted course.

Dr. Paul Reed presented several instances of the clinical application of gramicidin in conjunctivitis, with quick results.

*Discussion.* Dr. John Osburn emphasized the ability of discarding the misnomer "shipyard conjunctivitis" in favor of its proper terminology. He said that after all it was not a new entity, that it had been described before, and had been discussed by Col. Robert E. Wright at the Midwinter Course of the Research Study Club of Los Angeles in 1936. It was probably caused by a virus, as already stated by many, as cultures he had taken were negative for bacterial growth.

Harold F. Whalman,  
*Editor.*

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## PUBLICIZING THE PROFESSIONAL MAN

The layman and, unfortunately, many engaged in the professions often fail to understand or recognize the fundamental differences distinguishing a professional career from a commercial occupation. Consequently laws, regulations, and practices common to the latter are frequently believed applicable to the former. Since in the near future the public will be called upon to pass judgment on proposed legislation dealing not only with trades, unions, and commerce but with the professions as well, it behooves us as profes-

sional men to differentiate our particular problems as clearly as possible and present them to the public so that its opinion may be affected by our point of view.

The first step in this direction must be to define the professional man in terms in which we would like to introduce him to the public. Once we have created a professional prototype that merits the genuine respect and admiration of all, we can hope that doctors will be encouraged to emulate this publicized creation and so gain public confidence to the extent that public opinion in matters pertaining to medical men and medical care.

will be but a reflection of their own views.

The old family doctor acquired a position of authority and esteem without resorting to publicity through the fact that everyone in his village knew him intimately and appreciated his adherence to the Hippocratic oath. Today our patients are unable to know their doctors intimately, a hiatus having resulted from modern living conditions, but this can be bridged by a program of education designed to enlighten the layman regarding the professional and ethical requisites of various medical organizations and societies. In this way the public would be taught to recognize the groups, and hence the individuals in the groups who, cognizant of their obligations as professional men, have chosen to abide by certain standards that protect the layman from charlatanism and deficiency in skill. He would not feel a need for further protection by increased governmental activity in the regulation of medical practice.

Primarily the layman must be taught to realize that the professional man who merits admission to the national medical organizations and societies is characterized by two fundamental requisites. First, he must possess special knowledge and training unobtainable except through a rigorous course of education and apprenticeship open to a select few having unusual ability; that is, special knowledge of such value to society that its acquisition is applauded. Second, he must possess a professional philosophy from which is derived a code of ethics governing the manner in which this particular knowledge will be used. The first makes available expert advice and opinion and the second insures that only unprejudiced advice and opinion will be rendered. It becomes the grave responsibility of the societies then, if they are to be effective in shaping public opinion, to censure and

debar those doctors who do not possess the professional philosophy.

The professional man, unlike the individual dealing in commerce, has only advice and skill to offer, which, although invaluable at times, are often less tangible than commercial goods and consequently not so readily appreciated. This situation is particularly apparent if the advice or opinion is of a negative nature, as when the doctor, lawyer, or engineer, after long and thorough study, pronounces the "status quo" as satisfactory. The layman has not been educated to value this finding as much as if it were a positive or concrete one, although the knowledge and experience from which the judgment is derived is no less valuable than in cases wherein the finding is positive, and a change in "status quo" prescribed. The negative advice has the same intrinsic value as far as meriting compensation for professional service is concerned. However, those among us who can collect the same fee for not prescribing as for prescribing treatment, whether it be pills or glasses, are rare indeed, although not extinct, and the envy of all. Attainment of such a position implies the ultimate in professional practice and the public's appreciation of it, and should be the goal of professional men.

This goal can be reached only to the extent to which the public realizes that the opinion or advice rendered is expert in that it is in keeping with the best knowledge available at the time and is impeccably free from any considerations other than the findings "per se." Hence our publicized professional man scrupulously avoids any practice that could possibly be construed by the public as biasing his judgment. He cannot profit from the sale of merchandise resulting from his professional advice. He barricades himself against any associations that might imply such profit, as, for example, hav-

ing commercial houses act as his agents. He does not dispense drugs or appliances for the same reason, that in so dealing with merchandise it could be assumed by his patients that his prescriptions might be in excess of the actual need demanded by the medical requirements of the case. It is true that few doctors would care to profit by such practices destined to influence public opinion against their recommendations and generally bring discredit to their profession. Nevertheless, the public is not necessarily tolerant of a doctor's good intentions, and we have to admit that we are faced, from time to time, with scandals such as the recent rebate situation in New York City, publicized by the "New York Times," where the performance of certain doctors, not possessing a professional philosophy, has rendered them and their colleagues vulnerable to a campaign by the public for political investigation and control of medical practice.

In seeking advice or help from professional colleagues, or in referring patients to them, or to laboratories, the professional man uses only those men who, he believes, can do the most for his patient, not those who will do the most for him. He abhors any practice that could be interpreted by patients as jeopardizing this principle. Even though he may rationalize that a referral to a particular colleague who compensates him for the act is in the best interest of the patient, his abstract thinking is sufficiently clear to make him realize that such practices are detrimental to public respect for his profession as a whole and that he must be on guard against these practices, however minor the point at issue may seem to be. He is fully aware of the fact that his authoritativeness and dignity, essential qualities of the true professional man, stem from the inner feeling that he has ministered to his patient

to the limits of available skill and ability uninfluenced by considerations of remuneration.

At this point we might pause to realize that we are publicizing this idealized professional man for purposes of capturing and holding public confidence in our group to the end that we may dictate our own destiny without having politicians do it for us.

This professional man is being advertised by us as a group. As an individual he shuns any advertising inasmuch as it could be interpreted as signifying undue interest in material profit from his work or that such interest, rather than the satisfaction of professional attainment and the knowledge of his influence in his particular sphere, might be his prime motive. He most certainly could not long retain respect and effectiveness if it were known that he practiced in a way that would bring him the most money rather than in the way that is best for his patient. Our professional man is anxious to do outstanding work and to discuss it with his colleagues so that he can be known to them and admired by them. But at the same time he is sufficiently farsighted and endowed with professional pride and consideration for his colleagues to realize that personal publicity in lay publications sets an example that ultimately defeats the whole scheme of gaining public confidence, because such a practice indicates primary interest in profit for self rather than in benefit for another.

The paragon of virtue that we are promoting may seem too good to be human and practical, and would seem ridiculous in business life. Yet our entire medical tradition, proceeding from the original inspiration of the Cult of Aesculapius, matured into a system of professional ethics made practical by such leaders as Hippocrates, Vesalius, Osler, and Helmholtz, has been accepted by the public to the



extent that when John Doe is really ill, or, more important, has an acutely sick child, this quintessence of professionalism is the kind of healer to whom he would like to believe he has entrusted the care of himself or his child. Present trends and practices endanger this tradition and the attendant confidence derived therefrom, and the problem before us is to determine whether or not it is sound, both professionally and economically, to reassert ourselves in a way that will retain and perpetuate this confidence.

It is very true that the public's choice often seems to belie the statement that the layman seeks out the truly professional man, but ignorant, uninformed people make peculiar choices. However, motion-picture producers, whose job it is to appeal to these people in characterizing their hero doctors, realize perhaps better than some of us the spiritual type of man the public wants for its physician. They point the way for us to follow in building up this side of our professional man for purposes of publicity. As a matter of fact, if the public at times makes incomprehensible choice of physicians we can blame ourselves for not having a more active program of public enlightenment. It is the professional man's duty to be active in such a program as a means of furthering public health.

The truly professional man is primarily a student interested in his work and motivated by a desire to be practical in his healing art, scientific in his appraisals, and creative in his attempts to improve and add to the knowledge of his profession. His satisfaction in life comes from these activities. Although he can be financially successful, such success is not attained by prostituting his professional judgment to commercial practices.

This satisfaction is the origin of that certain altruism so characteristic of the

publicized "family doctor." It erases all greed and selfishness. It antidotes the possibility of bribery, coercion, or agency relationships, making the private physician as free and independent in action as is possible for any individual to be in our interdependent society.

At this point the question might be raised, why publicize a prototype out of keeping with the modern trends of industrialized and socialized medicine? It is very true that our "to-be publicized" professional man is out of keeping with the planned economy and medicine envisioned in prevalently proposed legislation where independence of thought and action would necessarily be subjugated to considerations of pleasing the directors of such a plan. The physician's incentive naturally would be to please his superiors in the organization rather than to please his patient or himself. In such a plan the physician's responsibility to the patient is often minimized, particularly if free choice of physician is not actually realized. Consequently the patient's detailed care would suffer in proportion to this loss of sense of responsibility. Conscientious men assume responsibility up to a certain point, but when ministration to their patient is so controlled by standardization of procedures that they have no freedom of action in the individual case even the most admirable character will shrug his shoulders and give up.

It is difficult to see how our idealized professional man could survive in a controlled system of medicine that is liable to deprive him of the very virtue for which we value him most—namely, the rendering of expert opinion unprejudiced by any consideration other than the welfare of the patient. Certainly our professional man must champion trends toward improved care for the average patient at lower cost, but the mechanisms by which

these ends are brought about should not lower our standards of professionalism, or we run the great danger of making the pursuit of our profession unattractive to those intellects and free spirits in the future who could contribute most to the advancement of medicine. Publicizing what true professionalism means to the doctor and the patient cannot result in anything but benefit to both, especially now when the public has in mind the much publicized "Kick back" investigation in New York (see *Medical Economics*, 1944, January).

Scientists above all men value working conditions conducive to free thought and action. The public must be made to realize the value in this, and even though government assumes a more and more important place in medicine the value of private medicine and institutions where action is free of political control must be acknowledged as an absolute necessity for the furtherance of science. A proper comparison would be the valuable influence of private educational institutions in this country where public education is accepted as a matter of course.

Certainly, our ultimate aim in the field of contractual medicine should be to develop systems of contract whereby the intellectual relationship of the doctor to all those to whom he renders his special knowledge should be free from any influence jeopardizing his professional philosophy of unbiased expert opinion, free from bias actual or implied, for, as we have pointed out, every such influence will undermine public confidence in the profession.

We must be on guard against becoming part of any business arrangement or political organization that pays closest attention to the advantages of the moment and ignores the resultant decline in respect and authority upon which the pro-

fessional man's effectiveness and future contributions for the benefit of mankind ultimately depend.

S. Rodman Irvine.

### CONGENITAL CATARACT AFTER RUBELLA IN THE MOTHER

The question as to whether or not this syndrome of congenital cataract, usually associated with other malformations in the offspring of mothers who have had so-called German measles, is something new is a challenging one. That it could have been happening for a long time and have remained undescribed before 1941 is possible but unlikely. The very fact that some 78 cases were described in a community of only a few million people before any cases were described elsewhere is in itself very suggestive of something new under the sun. With the description of three cases by Dr. Reese in this *Journal* in May there have been many others cropping up in the United States. The writer has seen two certain cases and one probable, and knows of at least one other in Saint Louis in the past three months.

Almost everyone will recall the epidemic of mild measleslike eruptions with slight fever that swept our country in the spring and summer of 1943. It was so mild that most people were not confined to bed with it and many undoubtedly had the disease without even being aware of the fact. The crop of defective children in pregnant mothers who were afflicted is only now coming to light. It seems most probable that a new virus—or a modification of an old one—has travelled across the world, as have disease epidemics for centuries past, and left these sad little derelicts in its wake.

Those patients that the writer has seen have been very miserable little specimens.

They were badly underweight, averaging about 10 pounds at 7 to 9 months, cyanotic because of their serious heart conditions, and with very feeble tenures on life; so poor indeed that in one case the baby died not long after a needling of the second eye. A whiff of ether had been given for each operation and though this was not thought to have been responsible in any way for the death 24 hours after the second, it was decided to use nothing but local anesthesia in the next case. This was very simply done, with apparently no discomfort to the infant. Noteworthy is the fact, also commented on by Dr. Reese, that two of these babies were very intolerant to even very small doses of atropine. One drop of 0.25 percent caused a temperature rise of from 2 to 4 degrees with marked flushing. That it was the atropine was confirmed by a repetition of a similar event when the drop was used in the second eye of the first child and in one eye of the second child. The reaction to atropine, however, is only one manifestation of an unstable heat-control mechanism, because these patients not only developed high fever from minimum doses of atropine, but also in response to other stimuli, such as the temperature of a very hot day. Probably there is a lesion of the heat-control center.

The cataracts have all been of the same type—nuclear. At operation it was easily possible—as suggested by Dr. Reese in conversation—to tip the opaque nuclei into the anterior chambers with the knife-needle and cut them into small pieces after which they were rapidly absorbed.

It behooves ophthalmologists everywhere to be on the lookout for this condition and for some of those who have facilities for so doing to conduct investigations of the possibilities of reproducing this disease in monkeys, but most important to advise that every precaution be taken to prevent exposure of pregnant

women to infection with this rubella or rubellalike disease.

Lawrence T. Post, M.D.

## BRITISH OPHTHALMOLOGISTS AND OPTICIANS

Many criteria may be found for gauging a nation's progress in civilization. One of the most important criteria is the degree of development of the science and art of medicine. An effective argument might be made out for grading populations by the extent to which refractive errors are corrected.

In some countries the extremes of wealth and poverty are so great that, although the eyes of the favored few receive excellent care, and although extreme errors of refraction are given fairly adequate attention in the public clinics, the vast majority of men, women, and children know little of the benefit and comfort to be derived from correction of moderate amounts of hyperopia, myopia, and astigmatism.

In at least one European country, generally regarded as in the forefront of civilization, the law has denied to the dealer in optical goods all right to measure a customer's refraction. It may be suspected that this fact has hindered, rather than stimulated, the medical practice of refraction. In the United States, on the other hand, and in various parts of the British commonwealth of nations, nonmedical refractionists have obtained a large measure of public recognition and have become numerically significant. In this large group of English-speaking communities, refractive technique and patronage have reached their highest development.

The controversy as to the relative merits and abilities of medical and non-medical refractionists is constantly with us and has been the subject of many bit-

ter fights in parliaments and legislatures. In the United States, the constitutional privileges of separate state governments have resulted in widely varying standards of optometric regulation. The optometrist has won legal recognition throughout the country, yet for the most part his educational status is fearfully and wonderfully neglected. Only in a few areas is anything like a university basis of education for the optometrist required, and it is in those areas that a fairly rapid advance in the standards of optometric practice may be anticipated.

In Great Britain, the centralized form of government has favored a considerably more uniform treatment of the optometric problem, the better class of "sight-testing opticians" being usually diplomates of one or other of the two leading optical organizations, namely the British Optical Association and the Spectacle-makers' Company.

The British government has recently announced its intention to establish a comprehensive health service for everybody in Great Britain. ("A National Health Service," the British government's eighty-five page pamphlet, has been reissued in the United States by The Macmillan Company.) This proposal, with regard to which the government invites frank criticism and discussion by various sections of the community, has naturally given rise to British medical criticism somewhat similar to that accorded to the Wagner-Murray-Dingell Bill in the United States.

The Council of the British Medical Association, whose president, Lord Dawson, has described the government project as "a genuine statesmanlike endeavor to meet an extremely difficult position," has issued a report on the government scheme (British Medical Journal, 1944, May 13, page 643). The Association has prepared a Draft Scheme for a National

Eye Service, and the Council of British Ophthalmologists has appointed a subcommittee to consider this Draft Scheme. The British optical profession has appointed its own "Beveridge Report Committee."

British ophthalmologists are especially interested in the question of their status as consultants under the proposed law, and some guidance as to this relationship will undoubtedly be derived from professional experience with consultant work under the already existing organization of National Health Insurance.

An article in the British Medical Journal from the pen of an English ophthalmologist (Walker, "The ophthalmic surgeon and the optician," 1944, April 22, page 560) argues that the sight-testing optician should be retained and utilized, under the proposed National Health Service, by giving him a position subordinate to, but coordinated with, the activities of the ophthalmologist. ("On receiving his diploma," says this writer, "the optician will become a medical auxiliary.") Walker is apparently disposed to allow the refractive error to be measured by either the ophthalmic surgeon or the optician, "according to the nature of the case or the direction of the surgeon." The optician would naturally undertake frame measurements and arrangements for manufacture and supply of spectacles.

Mr. Walker's proposal has naturally given rise to comments, chief of which is in the form of a long letter from W. B. Barker, Chairman of the optical profession's committee for study of the government scheme.

Although recognizing that ophthalmic optics has a much wider field than refraction alone, Barker regards refraction as "the essential function of the optical practitioner." He remarks that, inasmuch as refraction is "based on the science of

physics and is concerned with the adequacy of healthy eyes, it thus differs from ophthalmology, which is traditionally occupied with disease." He further alleges that the potential value to the community of ophthalmic optics has been "gravely and grossly underestimated by official medicine." This statement may be compared with the accusation frequently made by leading optometrists in the United States, to the effect that the medical profession, and medical licensing authorities, are grievously at fault in permitting the practice of refraction by medical men whose basic medical education gave them no training in the subject.

It is significant that, while Barker is apparently willing to accept, or even to encourage, state control of sight-testing opticians, he is not disposed to tolerate the proposal that his colleagues shall be placed under medical control. He urges that the wide field of public health requires the development of "separate and complementary professions" (namely ophthalmology and optics).

The sort of feud which smolders, and flares up here and there, between the two groups, ophthalmologists and opticians, depends upon two factors: first, a real need for protecting the public against ignorant and unqualified practitioners of any kind; second, economic rivalry.

Walker, in the article already referred to, explains the attitude of hostility of some ophthalmologists toward opticians as born of fear and of a reluctance to face facts. "All this fear," he says "is unnecessary, for there is work for all."

"Let any ophthalmic surgeon," he continues, "count how many opticians of all kinds there are in his own district or town, and let him assume that they make a sufficient income to keep their 'shop' open, and then let him remember that under this plan every member of the public needing advice will have to be seen by the 'team'; then having done this, I cannot understand how he can say that there will not be enough work for ophthalmic surgeons, the opticians, and the rest."

Walker, the ophthalmic surgeon, is here of course anticipating the consequences of the plan which he himself proposes for Great Britain. But there is economic sense, and sound regard for public need, in his general willingness to contemplate a division of labor between ophthalmologists and opticians in the same community. The vital necessity seems to be for adequate knowledge and training on both sides, together with complete realization that public interest is paramount to professional selfishness.

W. H. Crisp.

# ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

## CLASSIFICATION

1. General methods of diagnosis
2. Therapeutics and operations
3. Physiologic optics, refraction, and color vision
4. Ocular movements
5. Conjunctiva
6. Cornea and sclera
7. Uveal tract, sympathetic disease, and aqueous humor
8. Glaucoma and ocular tension
9. Crystalline lens
10. Retina and vitreous
11. Optic nerve and toxic amblyopias
12. Visual tracts and centers
13. Eyeball and orbit
14. Eyelids and lacrimal apparatus
15. Tumors
16. Injuries
17. Systemic diseases and parasites
18. Hygiene, sociology, education, and history
19. Anatomy, embryology, and comparative ophthalmology

### 1

#### GENERAL METHODS OF DIAGNOSIS

Agatston, Howard. *Ocular malingering*. Arch. of Ophth., 1944, v. 31, March, pp. 223-231.

This paper, based on the examination of soldiers, is designed not merely to give a list of malingering tests, but rather to present a working classification of ocular malingering.

The author says that in routine Army-induction examinations the incidence of ocular malingering is from 0.5 to 3.0 percent. He quotes Shastid's definition of simulation as the feigning of an ocular disease or injury which does not exist; of false attribution as the assignment of an untrue cause to an existent disease or injury; and of exaggeration as the pretense that an injury or disease which really exists is greater in extent or severity than is really the case. Negative malingering is denial or dissimulation of an existent disease or defect.

These forms of malingering are then systematically discussed under four main heads: (1) errors of refraction,

(2) amblyopias, (3) organic diseases, (4) defects in color vision. (3 tables, references.) R. W. Danielson.

Belgrano, C. R. *The oculophrenic-recurrent syndrome in cancer of the lung*. La Semana Med., 1944, v. 51, Feb. 24, pp. 367-370.

In tuberculosis, pupillary inequality and neuralgia or paralysis of the corresponding side of the diaphragm are frequently encountered. The author states that the associated existence of paralysis of the phrenic and recurrent laryngeal nerves is more characteristic of cancer of the lung, especially if occurring on the left side. He describes such a case. (One illustration.)

W. H. Crisp.

Bugnone, Enrique. *Vitamin A, hemeralopia, and the biophthalmometer*. Analès Argentinos de Oft., 1944, v. 4, Jan.-Feb.-March, pp. 6-17.

The author reviews the history of the use of vitamin-rich substances for the treatment of ocular diseases since the time of the ancient Egyptians. He

describes the biophthalmometer and its usefulness in detecting deficiencies of vitamin A. The relation between hemeralopia and the formation of visual purple is discussed and the literature cited. (2 figures, bibliography.)

Eugene M. Blake.

Busacca, A. A simple and practical method of stereoscopic ophthalmoscopy. *Anales Argentinos de Oft.*, 1943, v. 4, April-May-June, pp. 47-54.

Busacca has used the corneal microscope and slitlamp for stereoscopic study of the fundus. The contact lens is employed, permitting a clear view of any part of the eyeground. It is possible to differentiate preretinal from retinal lesions, and to study vascular dilatations, the depth of small hemorrhages, changes in the retinal pigment layer, and so on. Eugene M. Blake.

Epstein, B. S. and Kulick, M. A technique for optic-foramen roentgenography. *Radiology*, 1944, v. 42, Feb., p. 186.

In the absence of a Pfeiffer angle device or the adaptation of the Bullitt mastoid localizer, a satisfactory method which will give fairly uniform results is described. A cassette is placed on a 2-inch block, and a cone with a 3-inch aperture is focused so that the central ray passes through the center of the film. The tube and cone are then elevated and the patient, in the prone position, is placed so that the malar eminence, the tip of the nose, and the superior orbital ridge form the angles of a roughly equilateral triangle in the circular roentgenographic field. The superior orbital ridge is then elevated one inch from the cassette and is held in position by a wedge of felt. The central ray is thereby directed perpendicularly downward, passing about

$\frac{3}{4}$  inch mesial to the external canthus of the eye. On the roentgenograms the optic foramina appear as circular structures in the lower portion of each orbit, avoiding the foreshortening and oval shadow frequently obtained with other methods.

An angle-board technique is also described. The physical factors used are as follows: approximately 55 kv.; 50 ma. seconds; cone 7 inches long, with 3-inch opening; screens, par speed.

Owen C. Dickson.

Gartner, S., and Lubkin, V. Eyes from autopsies. *Amer. Jour. Ophth.*, 1944, v. 27, May, pp. 527-529.

Michaelson, I. C. Defective night vision among soldiers; dark-adaptation results and their use in diagnosis. *Brit. Jour. Ophth.*, 1944, v. 28, March, pp. 140-147.

The Koch dark-adaptometer is described and its accuracy in measuring both minimum light and form sense is estimated. The following conclusions are drawn from experimental observations of subjects with and without complaints of defective night vision: (1) The normal minimum light sense and form sense vary, but together they afford a fairly satisfactory measure of individual ability to see in the dark. (2) Cases of defective night vision have poor minimum form-sense. (3) Measurement of minimum light-sense after three minutes dark adaptation does not appear to be of any diagnostic significance. (4) Measurement of minimum form-sense after thirty minutes dark adaptation also appears not to be diagnostically useful. There are indications that poor minimum light-sense is associated with organic disturbance and good minimum light-sense with func-



tional disturbance, as the cause of defective night vision. (5) Dark adaptometers which measure only the minimum form-sense have limited usefulness because such instruments give no help in distinguishing between physiogenic and psychogenic defective night vision, and certainly this differential diagnosis is one of the chief problems of oculists investigating defective night vision in large groups of people. (3 figures, 3 tables.)

Edna M. Reynolds.

Nicholls, J. V. V. *Ophthalmology in the R.C.A.F.* Canadian Med. Assoc. Jour., 1944, v. 50, April, pp. 335-338.

Early in the war the "Projecto-Chart" was adopted for measuring visual acuity instead of the Snellen charts. The Maddox rod replaced the red and green box, a color-vision test was adapted from the American Optical Company's color charts by eliminating the less useful plates, and a new color-lantern test is in process of construction. An improved spectacle frame is furnished air crews, correcting lenses being in surface-hardened glass. Several new instruments are being made in Canada, modelled largely after British instruments. Their details are not mentioned. A small number of patients are benefited by orthoptic training. Night vision is tested with a rotating hexagon, using female ophthalmic assistance which also helps in orthoptic and secretarial work. The organization of the ophthalmic division of the R.C.A.F. is described in some detail. The large unit consists of an experienced ophthalmologist, two to three medical officers under instruction, and three to four female ophthalmic assistants. The small units consist of one ophthalmologist and one female assistant. Where necessary, an optometrist

refracts under supervision of the ophthalmologist in charge.

Charles A. Bahn.

Paulo, A., Jr. *Orbital emphysema as means of radiologic contrast.* Rev. Brasileira de Oft., 1943, v. 2, Dec., pp. 85-92. (See Section 13, Eyeball and orbit.)

Raaf, John. *The perimetric diagnosis of intracranial tumors.* Trans. Pacific Coast Oto-Ophth. Soc., 1942, v. 27, pp. 131-144.

The author stresses the importance of field-taking, not only by ophthalmologists but by neurologists, in diagnosing intracranial lesions whenever the patients are mentally and physically able to cooperate, which is in about two thirds of all patients. He notes that none of the fibers of the visual pathways lie in the frontal lobe; and hence that frontal-lobe tumors do not usually produce visual-field defects. This thorough paper is valuable for review of the anatomy of the visual pathways and its study of the field defects produced by intracranial tumors.

Lawrence G. Dunlap.

Sloane, A. E., and Gallagher, J. R. *A practical ophthalmic test which furnishes quantitative data.* Arch. of Ophth., 1944, v. 31, March, pp. 217-222.

The testing of vision as part of an annual medical examination of adolescents is an important procedure, and in the ideal situation would most effectively be carried out by a qualified ophthalmologist. Since such highly qualified personnel is seldom available, one must usually rely on a device designed to screen out persons who would benefit by a more thorough examination. For such purposes the Massachusetts vision test has proved adequate. However, there is a need, under certain con-

ditions, for a visual test which furnishes quantitative data for purposes of classification and yet can be effectively administered by a technician.

In the present report a modification of the Massachusetts vision test is described. The authors' experience with it in testing 797 adolescents is discussed, and its efficiency and the results obtained are evaluated in detail.

The Massachusetts vision test is divided into three parts: first, a test for visual acuity; next, a test for the detection of latent hypermetropia of a substantial degree; last, a test of binocular balance. The authors' technique differs from the Massachusetts vision test in that it provides quantitative measurements of heterophoria and calls for a report on all parts of the test. This modification does not replace the Massachusetts vision test in its sphere of usefulness as a means of screening out children who require further examination of the eyes; but it is applicable only when quantitative visual data are required. (One figure, 2 tables, references.)

R. W. Danielson.

Wescamp Irigoyen, R. The "ophthalmofundiscope"—a simple apparatus for stereoscopic study of the fundus. *Anales Argentinos de Oft.*, 1943, v. 4, April-May-June, pp. 63-64.

The author couples the objective and ocular of the corneal microscope to study the fundus. A prism is inserted in the ocular to obtain binocular vision, and a small automobile-headlamp bulb with a linear filament gives the illumination. For details of construction one should read the original. The writer claims a clear view of the eye-grounds with his instrument.

Eugene M. Blake.

## 2

## THERAPEUTICS AND OPERATIONS

Alvaro, M. E. Sulfonamides in ophthalmology. *Rev. Brasileira de Oft.*, 1943, v. 2, Sept., pp. 2-17.

This is a general review of the effects of the sulfonamides, and of complications arising from them, as presented in the literature. The complications mentioned include edema of the eyelids, transitory myopia and other refractive changes, optic neuritis, iritis, edema of the retina, and retinal hemorrhage. Of 36 recorded cases of transitory myopia, 33 resulted from the use of sulfanilamide and three from sulfapyridine. (Bibliography.)

W. H. Crisp.

Bunakov, V. L. Blood transfusion in ocular diseases. *Viestnik Oft.*, 1942, v. 20, pts. 1-2, p. 47.

Bunakov did 52 transfusions on thirty patients. Six cases of optic neuritis and eight of scrofulous keratoconjunctivitis are reported as cured. Of seven cases of vitreous opacity caused by tuberculous cyclitis, three recovered and four were improved. Transfusion was ineffective in one of two cases of optic atrophy and in one of panophthalmitis. It had a favorable effect in two cases of corneal ulcer, and in one of two cases of parenchymatous keratitis. Brief case histories illustrate the effect of this procedure on the course of various ocular lesions. The experience leads the author to the following conclusions: In many severe ocular diseases refractory to orthodox therapy, a blood transfusion may lead to rapid and permanent improvement. It should be used widely in scrofulous ocular lesions and may be helpful in optic neuritis. Transfusion is the only procedure (known

to the author) which stimulates absorption of vitreous opacities.

Ray K. Daily.

Fialho, Abreu. Studies with the suction cup of Werner Herzau. *Rev. Brasileira de Oft.*, 1943, v. 2, Sept., pp. 19-27.

This apparatus, consisting of a rubber ball attached to a glass tube carrying a suction cup at its other end, has been used to produce, for therapeutic purposes, an edema of the anterior segment of the eye. The author's use of the cup in a large number of patients produced either negative or indeterminate results. Experiments were made as to the effect of the suction cup in reducing intraocular pressure in cases of glaucoma. Material reductions in tension were produced, but in the secondary rise of tension following the treatment the tension became higher than it had been before the treatment was applied. The author proposes what he calls the suction-cup test for glaucoma, to be applied to prodromal cases. He states that any eye considered normal but which when submitted for five minutes to the action of the suction cup does not undergo a fall in tension at least equal to 50 percent of the original tension must be regarded as preglaucomatous. This determination is further confirmed if the secondary rise of tension, after use of the cup, amounts to approximately 10 mm. beyond the original tension. (4 graphs, 1 illustration.)

W. H. Crisp.

Kaminskaja, Z. A., and Tikhomirova, P. E. The use of short wave in ophthalmology. *Viestnik Oft.*, 1942, v. 20, pts. 1-2, p. 24.

The authors report briefly on three series of cases treated successfully with short waves, after the usual therapeutic

procedures had proved ineffective. One series had postoperative iritis, one had traumatic infections, and the third had purulent keratitis. The results were particularly good in postoperative and traumatic iritis, in the pathogenesis of which the important factor is traumatism to the sensory nerves of the iris. That the short waves act on the sensory nerves is indicated by the fact that the relief of pain runs parallel with improvement in the objective symptoms. The therapy is of value in purulent keratitis, on which it probably acts by dehydration of the colloids, in addition to exerting a thermogenic and bactericidal action. In traumatic infection it was ineffective. Ray K. Daily.

Khavin, H. O. Blood transfusion in traumatic iridocyclitis and other ocular diseases. *Viestnik Oft.*, 1942, v. 20, pt. 3, p. 31.

Khavin found blood transfusion of value as an adjuvant to the usual therapeutic measures in traumatic and tuberculous iridocyclitis. Six cases are reported to illustrate the favorable effect of the procedure in the relief of pain and absorption of hemorrhage in anterior chamber and vitreous. One case of severe intractable pannus due to trachoma and tuberculosis, having failed to respond to other forms of therapy, improved rapidly after a transfusion.

Ray K. Daily.

Kronfeld, P. C. Indications for paracentesis of the anterior chamber. *Jour. Indiana State Med. Assoc.*, 1944, v. 37, March, pp. 113-116. (See Section 8, Glaucoma and ocular tension.)

Laval, Joseph. Anterior-chamber irrigation with sulfadiazine. *Amer. Jour. Ophth.*, 1944, v. 27, May, p. 527.

McAlester, A. W., and Borley, W. E. A double-bladed knife for scleral incisions in shortening of the globe. *Amer. Jour. Ophth.*, 1944, v. 27, June, p. 641.

Medeiros, Jorge de. Physiotherapy in some phases of ophthalmology. *Rev. Brasileira de Oft.*, 1942, v. 1, Dec., pp. 63-69.

The author makes rather brief mention of the following therapeutic methods: electrotherapy, ionization, electrocoagulation, and fever therapy.

W. H. Crisp.

Nano, H. M. New model of blepharostat. *La Semana Med.*, 1944, v. 51, Feb. 24, pp. 374-378.

The apparatus consists of a rectangular metallic frame, hinged at the middle of each of its long horizontal sides, these horizontal sides being curved so as to permit of close application across the forehead and the lower part of the nose and cheeks, and the short vertical sides resting on the temples and being secured in place by tapes passing around the back of the head. An adjustable speculum whose blade resembles that used for raising the upper lid of a child can be attached to the upper horizontal bar, and another such short speculum to the lower horizontal bar, in such a way as to raise the upper and lower the lower lid, the blades of these two arms being the only obstacles in the operative field. Or the upper lid can be secured to the upper horizontal bar by means of a suture. (8 illustrations.)

W. H. Crisp.

Reeves, R. J. X-ray and radium therapy in lesions about the eye. *North Carolina Med. Jour.*, 1944, v. 5, March, pp. 85-87.

Soft beta rays are preferred because of their limited penetration and lesser likelihood of damaging the lens. Irradiation should be considered in inflammatory external ocular lesions which have resisted other therapeutic measures. In vernal conjunctivitis, a 50-percent erythema dose is used. One treatment may afford relief, but usually complete control is obtained only by numerous treatments at two-week intervals. In blepharitis and eczema of the lids, 4 to 5 weekly treatments of 100 to 150r are given. If not cured, another series may be given after a one-month interval. Recent corneal scars are more successfully treated by irradiation. Old scars should be treated for one year or more with small irradiation, dosage one to two months apart. In tuberculous disease of the cornea, sclera, and iris, small doses over a two-year period are advised. Epitheliomas of the cornea are frequently radiosensitive. If the lesion is large, enucleation is preferable, with subsequent radium or X-ray therapy. Epithelioma of the lids, if more than a few millimeters in size, should be treated with beta radium or soft X ray. Failures are frequently due to insufficient treatment. Lymphoma and angioma in and about the orbit should be treated by irradiation. For retinoblastomas enucleation is the method of choice. Charles A. Bahn.

Shereshevskaja, L. I. Short-wave therapy in inflammatory diseases of the eye and its adnexa. *Viestnik Oft.*, 1942, v. 20, pt. 3, p. 53.

Conclusions are drawn from a laboratory study on rabbits, and from clinical data. Short waves are safe in oligothermic doses. Intensive irradiation can produce immediate damage to the cornea. There is no late injury such

3

PHYSIOLOGIC OPTICS, REFRACTION,  
AND COLOR VISION

Batson, O. V., and Carpentier, V. E. **Stereoscopic depth perception.** *Amer. Jour. Roentgenology and Radium Therapy*, 1944, v. 51, Feb., pp. 202-204.

Physicians with little or no depth perception can obtain only slight benefit from stereoroentgenograms. Sixteen physicians entering the study of roentgenology were examined by the authors as to vision, refraction, stereoscopic vision, and fusion. Ten had acceptable depth perception (70 percent on stereometric cards). Three more had normal oculomotor and ocular function, but were apparently stereoscopically inert: a short practice period brought them to normal. Of the remaining three, one required ten days and one six months to become stereoscopically acceptable. The remaining physician had not acquired stereoscopic efficiency when this contribution was written. Roentgenologists should be examined stereoscopically, and should be given training if it is needed.

Charles A. Bahn.

Belmonte Gonzalez, N. **The residual astigmatism in the different ametropias.** *Arch. de la Soc. Oft. Hisp.-Amer.*, 1943, v. 2, Jan.-Feb., pp. 56-61.

Residual astigmatism is defined as the difference between the corneal astigmatism as determined by the ophthalmometer and the astigmatism revealed by subjective refraction. It is lenticular and is perhaps caused by tilting of the lens in respect to the visual axis of the eye. The author follows the biastigmatic method of refraction as practiced by Márquez.

J. Wesley McKinney.

as may develop following X-ray irradiation. Short-wave therapy is no panacea for any disease. It does however shorten and alleviate the course of the disease in corneal ulcers, corneal infiltration, and postoperative iritis. On rabbits a change in the caliber of the blood vessels following irradiation was not demonstrable. In four out of twenty patients the vessels dilated in two to three minutes after the beginning of the treatment, and contracted again immediately after the treatment stopped. In serpiginous ulcer this treatment did not arrest the progress of the ulcer; but when the ailment reached its acme short waves hastened healing. In superficial ulcers and corneal infiltrates the effect of short-wave therapy was very gratifying from the subjective and objective standpoints. The analgesic effect was pronounced in all cases. Postoperative infections were not arrested by this treatment, but it relieved the pain of postoperative iridocyclitis and it hastened recovery in iritis. In phlegmon of the lacrimal sac it was effective only if used very early. In infections of the lid and styes it overcame the process very rapidly.

Ray K. Daily.

Thygeson, Phillips. **Sulfonamide compounds in treatment of ocular infections.** *Connecticut State Med. Jour.*, 1943, v. 7, Nov., p. 746.

Pertinent literature on the use of the sulfonamide drugs in ophthalmology is analyzed in the light of the writer's personal experience with chemotherapy. Most of the details given in this paper will be found in papers previously abstracted in this Journal (1943, v. 26, p. 1233; and 1944, v. 27, p. 197).

Theodore M. Shapira.

Bilostozky, E. M., Ilina, S. A., and Mikhailov, H. M. The effect of diet on light sensitivity. *Viestnik Oft.*, 1942, v. 20, pts. 1-2, p. 52.

In a laboratory investigation on the effect of various diets on light sensitivity the following conclusions were arrived at: Qualitative changes in diet react on light sensitivity. It is reduced on a meat-and-dairy-products diet, and to a lesser degree on a vegetable diet. Light sensitivity begins to fall on the second day after changing from a normal meat milk and vegetable diet to a meat and milk diet; on the fifth day it falls to 55 percent of normal. Upon return to a balanced diet it remains low for two days and reaches normal three days later. A vegetable diet also leads to reduced light sensitivity, but the reduction is less marked and normal is reached on the third day after restoration of a balanced diet. For integrity of night vision it is essential to watch the diet, which should contain fresh vegetables along with meat and milk products.

Ray K. Daily.

Copps, L. A. Vision in anisometropia. *Amer. Jour. Ophth.*, 1944, v. 27, June, pp. 641-644. (References.)

Crozier, W. J., and Wolf, E. Flicker response contours for the sparrow, and the theory of the avian pecten. *Jour. Gen. Physiology*, 1944, v. 27, March, p. 315. (See Section 19, Anatomy, embryology, and comparative ophthalmology.)

Crozier, W. J., and Wolf, E. Theory and measurement of visual mechanisms. 10. Modifications of the flicker-response contour, and the significance of the avian pecten. *Jour. Gen. Physiology*, 1944, v. 27, March, p. 287. (See

Section 19, Anatomy, embryology, and comparative ophthalmology.)

Girling, W. N. M. Plastic, molded contact lenses. *Northwest Med.*, 1944, v. 43, Jan., p. 17.

Among the advantages of plastic molded contact lenses over the older glass-molded lenses are the facts that the plastic is not affected by the tears, that it can be trimmed or tightened, and that it is relatively indestructible. The contact lens has found a field of usefulness in high myopes, hyperopes, and astigmatics as well as in cases of corneal scarring, keratoconus, aphakia, and lagophthalmos.

After making castings of the anterior segment of the globe, with moldite, the author makes conjunctival cultures and determines the pH of the tears. If alkaline, as is the case with staphylococcus or streptococcus infections, the conjunctivas are treated with a sulfonamide preparation until the pH is at or near 7.4. The buffered lens solution is prescribed at a pH of 7.4. The author checks the fit of the finished lens by adding fluorescein to the lens solution and examining for areas of possible contact with the cornea, using a strobilite lamp and the slitlamp.

Benjamin Milder.

Kazdan, L. The use of a contact lens to improve vision in a seriously injured eye. *The Canadian Med. Assoc. Jour.*, 1944, v. 50, Feb., p. 157.

This article may be of interest in relation to similar cases resulting from war or from accidents generally. A male patient aged 32 years, first seen in 1939, had suffered the loss of his left eye and the right eye had traumatic aniridia and secondary cataract following limbal rupture, sustained in a

street-car accident in 1931. The patient was wearing a small +10.00 lens fixed behind a pinhole disc in the right half of his eyeglass frame. The vision was 20/50, the field very narrow, and getting about was difficult. The author performed a needling and made a cast of the conjunctival sac. A contact lens with a +10.00 correction was made and was painted black except for a central pupillary area. With this the patient obtained "100 percent normal" vision and a field which enabled him to return to his normal pursuits even to the extent of driving his car.

F. M. Crage.

Lijo Pavia, J. *Myopia gravis. Pigmentation, hemorrhages, and sequelae.* Rev. Oto-Neuro-Oft., 1943, v. 18, Jan.-Feb., pp. 15-25.

After experimental work begun in 1939, in cases of high myopia with fundus pathology, the author claims some beneficial results following administration of vitamin K and synthetic sex hormones. A menopausal individual, a high myope with severe chorioretinal atrophy, papillary excavation, and macular pigmentation, had a subjective visual improvement of the left eye from 1/25 to 1/8, and of the right eye from counting fingers at 0.4 meter to 1/50 (corrected). There was, too, a satisfactory improvement in the fundus picture after the administration of both ovarian and testicular hormones. In another high myope with severe chorioretinal changes including hemorrhages in the retina synthetic vitamin K apparently caused disappearance of the hemorrhagic areas, but visual acuity did not improve. The author has embellished his paper with excellent black-and-white and color retinographs, pictured singly and in panorama.

Edward Saskin.

McFarling, A. C. The clinical importance of refractive errors. Jour. Oklahoma State Med Assoc., 1944, v. 37, March, p. 96.

A ten-year-old boy was examined for a few seconds with an ophthalmoscope. Following the examination the boy became pale, soon his face muscles were twitching, then he vomited, and finally he fell into a general convulsion. Atropine examination revealed a compound astigmatic error of refraction. The author believes that the peculiar behavior of the child was due to eyestrain. If an irritation is greater in intensity than the minimum required for sensation in the particular nerve cell, then it may radiate and superimpose itself on adjacent neurons. The nuclei of the nerves of the ocular muscles, of the facial nerve, and of the vagus lie beneath the aqueduct of Sylvius on the floor of the fourth ventricle. A constant irritation like eyestrain will radiate to adjacent nuclei and may thus be instrumental in producing such gastric symptoms as were encountered in this case, and when such excitation spreads over a large part of the brain it may result in a convulsion.

R. Grunfeld.

Noyes, J. R. Two unusual symptoms of eye strain. Laryngoscope, 1942, v. 52, May, p. 376.

A middle-aged woman with deafness and an annoying tinnitus was completely relieved of her "head noises" on correction of a hyperopic-presbyopic refractive error. Proof of the relationship was established by recurrence of tinnitus, first on omitting the glasses for a few days and second upon control of later relapse by increasing her presbyopic addition. Several such cases have since been seen by the author.

Globus hystericus is another symptom which in the absence of abnormal



food and air-passage findings may respond to correction of refractive errors. Two cases are quoted, each in an individual with high-strung nervous system. Both were relieved by adequate lenses. Symptoms recurred later with increasing loss of accommodation, but responded to increased presbyopic correction. Owen C. Dickson.

Pimentel, P. C. Influence of the ametropias upon character. *Rev. Brasileira de Oft.*, 1943, v. 1, March, pp. 141-147.

As general tendencies in the myope, the author emphasizes the tendency toward reading and toward manual work, memory of what is read, preference for interiors, concentrated attention, introversion, timidity, tendency to analysis and deduction, paucity of friends. In hyperopes he finds tendency toward sports, memory for what is heard, preference for life in the open air, tendency toward inattention, expansiveness, tendency to inductive reasoning, and abundance of friends. These tendencies, however, are modified by the number of children in a family, the general tendency in myopia being corrected by growing up side by side with brothers and sisters; whereas a hyperope who is the only child and is privately educated tends toward the faults of character more usually attributed to the myope. The basic tendency of a refractive error is also modified by early correction with glasses, the corrected myope becoming less introverted, while the corrected hyperope (and also sometimes the myope) may be affected by the criticism which the glasses provoke among his companions and by the possibility of a changed relationship to sports. W. H. Crisp.

Pino, R. H., and Hultin, G. L. Treatment of asthenopia nonpathologic and

nonrefractive in origin. *Amer. Jour. Ophth.*, 1944, v. 27, May, pp. 520-523.

Sloane, A. E. Refraction clinic. *Amer. Jour. Ophth.*, 1944, v. 27, May, pp. 529-531.

Sloane, A. E., and Gallagher, J. R. A practical ophthalmic test which furnishes quantitative data. *Arch. of Ophth.*, 1944, v. 31, March, pp. 217-222. (See Section 1, General methods of diagnosis.)

Sugar, H. S. Suppression amblyopia. *Amer. Jour. Ophth.*, 1944, v. 27, May, pp. 469-476. (4 tables, references.)

#### 4

#### OCULAR MOVEMENTS

Barkwill, B. G. A review of diagnosis and treatment of 500 orthoptic cases. *Trans. Pacific Coast Oto-Ophth. Soc.*, 1942, v. 27, pp. 124-130.

The author believes in cutting hyperopic corrections one quarter per diopter and myopic corrections only a total of one quarter of a diopter. For orthoptic training he uses a synoptophore, a telebinocular, and prisms. In prescriptions he uses no lateral prisms and only two thirds of the average near or distance vertical imbalance over one degree and up to six or eight degrees. In amblyopia exanopsia up to the age of 12 years he bandages the good eye five days per week constantly for 6 to 36 months. In discussion it was brought out that orthoptists rather than oculists were doing most of the muscle-training work. A Navy commander stressed the fact that after orthoptic training ceased, the eyes slipped back to their original behavior, especially under conditions of anoxemia and fatigue, and he asked those

present not to give orthoptic training just for temporary relief. Another discussor differentiated between orthoptic training used in cases of muscle imbalance and that used in training squint cases. Lawrence G. Dunlap.

Barnard, R. I., and Scholz, R. O. Ophthalmoplegia and retinal degeneration. *Amer. Jour. Ophth.*, 1944, v. 27, June, pp. 621-624. (References.)

Fagin, I. D., Pagel, R. W., and Sand, H. H. Exophthalmic ophthalmoplegia. *Amer. Jour. Ophth.*, 1944, v. 27, May, pp. 504-514. (4 illustrations.)

Irvine, R. S. Increasing the action of a paretic inferior oblique by means of the O'Conner cinch shortening. *Amer. Jour. Ophth.*, 1944, v. 27, June, pp. 644-645.

Lancaster, W. B. Duties and training of an orthoptic technician. *Amer. Jour. Ophth.*, 1944, v. 27, May, pp. 515-519.

Ochaporski, S. V. Etiology of motor paralysis of the eye, *Viestnik Oft.*, 1942, v. 20, pt. 3, p. 3.

This is a review of the material of the Kuban Eye Hospital for the last thirty years. Among 296,000 ambulatory patients there were 997 cases of paralysis, divided as follows: paralysis of the facial, 295 cases; of the sixth nerve, 282; of the third nerve, 252; of the fourth nerve, 11; of the cervical sympathetic, 2; total ophthalmoplegia, 60; internal ophthalmoplegia, 90; paralysis of accommodation caused by diphtheria, 11; and from other etiology, 4.

In 66 of the 295 cases of facial paralysis, the disease began in childhood. Because of occupational exposure to colds it is more frequent in men. Of 23

patients who had a lagophthalmos keratitis, in two there was also paralysis of the trigeminal; most of these cases were in old people with long-standing paralysis. Three were in children, including a six-month-old infant with congenital paralysis, a seven-year-old child in whom the paralysis followed measles, and an 11-year-old boy with traumatic paralysis. The etiology of the facial paralysis is tabulated as follows: diseases of childhood, 25 cases; infections in adults, grippe and so on, 17; syphilis, 19; brain lesions, 7; arteriosclerosis, 19; trauma to the head or face, 24; disease of the ear, 16; operations on the ear, 22; operations on the parotid, 9; colds, 27; unknown etiology, 110.

The etiology of 282 cases of paralysis of the sixth nerve was: syphilis, 124; diseases of the brain, 39; cranial trauma, 20; infectious diseases, 19; spinal puncture, 21; congenital, 2; tuberculosis, 2; sinusitis, 1; unknown, 49. The frequency of sixth-nerve paralysis following spinal anesthesia led Russian surgeons and gynecologists to abandon this form of anesthesia.

The etiology of 243 cases of isolated paralysis of the oculomotor was: syphilis, 134; nonluetic diseases of the central nervous system, 33; cranial trauma, 20; infectious disease, 14; spinal puncture, 2; congenital, 3; paranasal sinusitis, 1; ptomaine poisoning, 1; unknown, 29. In 17 cases there was an isolated paralysis of the internal rectus. In cases of oculomotor paralysis there were also frequently other symptoms of disease of the central nervous system.

Of the 11 cases of trochlear paralysis, 3 were due to brain lues, 2 to operations on the frontal sinus, 1 to traumatism, and in the others the etiology was not determined.

Of 60 cases of total ophthalmoplegia, 40 were luetic, 8 traumatic, 3 caused by nonluetic diseases of the central nervous system, 5 by diseases of childhood, one postoperative.

The cases of internal ophthalmoplegia were all in patients over 16 years of age. Syphilis was the cause in 78 cases, fish poisoning in 2, encephalitis in 1, and in 9 the etiology was not learned.

Unidentified syphilis may have been the cause of some cases classified as of unknown etiology. In the syphilitic cases it was not always possible to determine the status of the disease, or to make differential diagnosis between tabes and neurosyphilis. Paralysis of the third, fourth, and sixth nerves was met but rarely in a large material of acute encephalitis, while paralysis of gaze was frequent. No case of multiple sclerosis was found in this material. In one case paralysis of the oculomotor was the first symptom of a tumor of the nasal sinuses. Ray K. Daily.

Reinhardt, P. H. Correction of external rectus paralysis with contracture of the opposing internus. *Amer. Jour. Ophth.*, 1944, v. 27, June, pp. 636-640.

## 5

### CONJUNCTIVA

Campos, Evaldo. More concerning submucous resection of pterygium. *Rev. Brasileira de Oft.*, 1943, v. 2, Sept., pp. 29-36.

Reference is made to recommendation of this technique by Edilberto Campos ten years or so ago. The author, and other Brazilian ophthalmologists, appear to have experienced many recurrences after operation upon pterygium by the McReynolds method. The author's description is unfortunately not supported by illustrations.

Apparently, after separating the head of the pterygium, he makes traction on this part in the direction of the center of the cornea, cuts across the neck of the pterygium cautiously so as to divide only the epithelial layer and then with scissors dissects away the submucous structures toward the caruncle and upward and downward. He uses no suture. (References.)

W. H. Crisp.

Dosorova, H. I. Pterygium operation with transplantation of mucous membrane from the lip. *Viestnik Oft.*, 1942, v. 20, pts. 1-2, p. 59.

The author's technique consists in excision of the pterygium, and covering the exposed surface with a flap of mucous membrane excised from the lip; sutures are used only occasionally, because the flap adheres well without them. In 134 cases there was no recurrence. Dosorova claims that this procedure has in addition a favorable effect on associated conjunctivitis.

Ray K. Daily.

McKee, S. H. Certain virus diseases of the eye. *Canadian Med. Assoc. Jour.*, 1944, v. 50, March, p. 261.

Viruses are defined as filter-passing, particulate matter, probably endowed with life, but obligate parasites having definite affinity for specific living tissue cells. The virus diseases listed as of interest in ophthalmology are vaccinia, herpes simplex, herpes zoster, varicella, lymphogranuloma venereum, trachoma, inclusion conjunctivitis, and the recently described epidemic keratoconjunctivitis.

Intracellular inclusion bodies, either cytoplasmic or intranuclear or both, are fairly characteristic of virus infection. Considerable difference of opinion has arisen regarding the interpretation

of what the different parts of the inclusion body actually mean. It is felt that the elementary body in its progress in division swells to form the initial body. This corresponds to young and old forms.

The virus etiology of trachoma and inclusion conjunctivitis has been established by proof of the transmissibility of the disease through the elementary bodies. Staining reactions and relative sizes of the elementary bodies of epidemic keratoconjunctivitis, vaccinia, fowl-pox, psittacosis, and trachoma are almost identical.

Owen C. Dickson.

MacManus, Adeline. *Survey of case notes of phlyctenular ophthalmia*. Irish Jour. Med. Science, 1943, Nov., pp. 611-612.

The writer made an investigation into phlyctenular ophthalmia among all patients who attended the Royal Victoria Eye and Ear Hospital in Dublin during the five-year period 1934-1939. The disease was found in 721 (1.6 percent) patients in a total number of 47,519. As to age incidence 26 percent of patients were preschool and 41 percent of school age, 11 percent adolescents, and 20 percent adults. The female sex was represented in the proportion of 59 percent. Seasonal incidence was: January to March 24 percent, April to June 23 percent, July to September 31 percent, and October to December 21 percent. The affection was unilateral in 74 percent, and in 52 percent of these it occurred in the right eye. In 3.5 percent of the cases the phlyctens were centrally located in both eyes. Regarding exciting causes, it was observed that the disease occurred as a sequel to acute infection in 15 instances, in 42 cases tonsils and adenoids were considered the source of infection and were removed, and in

4 cases septic cervical glands were present. Trauma as an exciting factor was mentioned in eight instances, episcleritis and iritis were present in two cases, eight cases were associated with blepharitis, and four with trachoma. In regard to complications, three phlyctenular ulcers were complicated with hypopyon, and in two cases enucleation was necessary as the ulcer perforated. As to housing conditions, 31 percent of the cases came from slums, 38 percent from the middle class, 6 percent from a more prosperous class, 2 percent in patients living in new flats, and 22 percent were from country places. The writer tabulates the incidence of phlyctenular ophthalmia in connection with the occupation of the fathers of affected children and the occupation of adult patients. He concludes that unemployment or death of the wage earner, and meager income, as probable cause of undernourishment poverty and bad housing, are important etiologic factors in the disease.

M. Lombardo.

Morrison, W. H. *Primary diphtheria of the conjunctiva*. Nebraska State Med. Jour., 1944, v. 29, Feb., p. 51.

A seven-month-old girl was brought to the author because she had a copious discharge of pus from the eyelids. The lids were edematous and red, but not indurated. The conjunctiva was injected, the cornea clear. Staphylococci were found in the smear and were cultured from it. Under sulfathiazole ointment, the discharge diminished. Two days later the child vomited. The lids were covered with a gray transparent membrane which could neither be wiped off nor torn away. Diphtheria bacilli were cultured from this pseudomembrane.

R. Grunfeld.

Price, D., and MacManus, A. *Report on an investigation into phlyctenular*

ophthalmia. *Irish Jour. Med. Science*, 1943, Nov., pp. 603, 610.

This report on 140 patients examined shows that 57 were under 5 years of age, 73 between 5 and 15 years, 2 were aged 15 and 1 aged 18. Of these 61 (44 percent) were male. A positive tuberculin reaction was elicited in 138 (98.5 percent) either by the percutaneous or by a secondary intradermal test in negative reactors. Active primary tuberculosis was present in 77 cases (55 percent), and progressive lesions were present in 17 (12 percent). The site of the primary focus in positive cases was: pulmonary, 102; cervical glands, 5; abdomen, 1; middle ear, 1; and in 29 no focus was found. Bone and joints lesions developed subsequently in 7 of the pulmonary cases. Of the 138 cases 72 were found to be suffering from radiologically demonstrable pulmonary lesions, the majority being in the primary stage. Physical examination showed dental defects in 22 percent and unhealthy tonsils in 25 percent, while among 140 cases 7 subsequently developed osseous lesions. In the writers' opinion phlyctenular ophthalmia should be approached from the tuberculosis angle, the eye lesion being merely an incident in the tuberculosis. (References.) M. Lombardo.

Rocha, Hilton. Primary conjunctival chromomycosis. *Ophthalmos*, 1943, v. 3, no. 2, pp. 205-211.

The patient, a 43-year-old merchant, was an enthusiastic hunter, a fact which the author adduces in relation to the statement that chromomycosis usually attacks laborers. In each eye, there were precipitates on Descemet's, and the media generally were hazy. After failure of various treatments including desensitization to tuberculin, biomicroscopy showed in the bulbar

conjunctiva of the right eye, close to the transitional fold, two small black points in size less than the head of a pin. Thinking of a parasite, the author excised these two nodules with a small fragment of conjunctiva. With appropriate staining, the pathologist found, beneath an area of conjunctival atrophy from compression, a granuloma, constituted by epithelioid cells and giant cells of the Langhans type, the central area of the granuloma being occupied by a colony of brown fungi. Between the two granulomas, in the lamina propria, was an inflammatory infiltrate, consisting of lymphocytes, plasmocytes, and eosinophiles. The pathologist proposed a diagnosis of conjunctival chromomycosis from *Hormodendrum Pedrosoi*. Two months later, the pathologist found mycelial filaments of a similar character in pus derived from a verrucous dermatitis of the patient's right foot. This is stated to be the first case of its kind reported in the world literature. (One clinical photograph, 4 photomicrographs.) W. H. Crisp.

Sherman, H., and Feldman, L. Hypersensitiveness of the mucous membrane. 4. The effect of local reactions elicited by specific and nonspecific excitants upon the ophthalmic mucous membrane in allergic and nonallergic individuals. *Jour. of Allergy*, 1944, v. 15, March, p. 77.

When the conjunctiva was stimulated with a nonspecific excitant, histamine, and after three to seven days was restimulated with a specific substance, for instance ragweed, then in 67 percent of the cases an increased vascular response occurred in the form of vascular dilatation. No consistent change in reactivity occurred when histamine was used for the initial excitation and for restimulation, or when

a specific substance was used for the initial excitation. R. Grunfeld.

## 6

## CORNEA AND SCLERA

Berezinskaja, D. I. Corneal transplantation in chemical burns of the eyeball. *Viestnik Oft.*, 1942, v. 20, pts. 1-2, p. 19.

This is a detailed report of a laboratory study on rabbits. Their eyes were burned with 10-percent sodium hydroxide or 30-percent sulphuric acid. The transplanted material consisted of cornea of dead rabbits, preserved on ice. The transplantations were made at various periods subsequent to the injury. The data show that after chemical burns the transplant becomes gradually replaced by connective tissue, more rapidly after acid than after alkali burns. The new connective tissue at first surrounds the transplant, then penetrates, and finally replaces it. The formation of connective tissue is preceded by vascularization of the injured cornea; the vessels advance from the periphery, surround the transplant, sometimes invade it. After acid burns the corneal vascularization is more abundant and the inflammatory infiltrate in the transplant and adjacent tissue is more pronounced. This infiltrated and partially necrotic tissue is gradually replaced by newly formed connective tissue. The cornea adjacent to the transplant becomes transparent several weeks after the transplantation, and this effect is attributed to the action of the transplant on the cloudy cornea. The transparency of the cornea following alkali burns is better than that after acid burns; the biochemical processes initiated by the transplanted tissue act better on cornea injured by alkali, because alkalies increase corneal permeability, while acids coagulate the

tissue. The data show much more frequent "taking" of the transplant after alkali than after acid burns, and more severe complications in the eyes where the graft failed to take after acid burns.

Ray K. Daily.

Chechik-Kunina, E. A. Keratoplasty in seriginous and purulent corneal ulcers. *Viestnik Oft.*, 1942, v. 20, pts. 1-2, p. 30.

On the basis of laboratory investigations on rats and of clinical experience in 16 cases, the report on which is tabulated, the author concludes that keratoplasty as a therapeutic procedure is superior to a keratotomy or a Zonderman trephining. Keratoplasty leads to fewer synechias and a higher visual acuity. In addition to the favorable effect of trephining, keratoplasty exerts a biologic action on the transplant. That the transplant possesses unusual vitality is indicated by the fact that placed in an infected area it suffers but slight initial infiltration, which rapidly clears up, the transplant then taking. The biologic effect of the transplant manifests itself in rapid resolution of the inflammatory process and restoration of corneal transparency. Pain ceases immediately after the operation, and the inflammatory process subsides. Progressive ulcers are promptly arrested, and within the next few days the cornea becomes clear, the infiltration disappears, the surface becomes covered with epithelium, and the defect is filled in. The resulting opacity is rapidly absorbed.

Considering the severity of the infections, surgical and postoperative complications are few. The unfavorable features of this operation are opacification of the transplant, frequency of anterior synechia, and associated rise in intraocular tension. The results of par-

tial keratoplasty were not satisfactory in this type of ulcer. Ray K. Daily.

Gifford, S. R., Puntteney, I., and Bellows, J. Notes on keratoconjunctivitis sicca. Trans. Amer. Ophth. Soc., 1943, v. 41, p. 80. (See Amer. Jour. Ophth., 1943, v. 26, Dec., p. 1343.)

Loewenstein, A. Herpes corneae and virus infection. Glasgow Med. Jour., 1944, v. 141, Feb., p. 54.

The author discusses in general virus infection in ophthalmology and corneal herpes in particular. In 1911 Grueter discovered the transmissibility of corneal herpes to rabbit cornea. In 1919 the author was successful in transmitting the contents of the labial herpes vesicle to the cornea of rabbits. His technique was as follows: The blade of a Graefe knife was dipped into the content of a lip vesicle, then two horizontal, not too superficial, corneal sections were made. Forty-eight hours later many delicate vesicles were seen with the loupe along the superficial incisions. Under the slitlamp the lesion appeared as a grayish-white infiltrate. After three days the whole central area was covered with a grayish-white infiltrate and there was an accompanying iritis. The corneal ulcer never appeared dendritic in shape. From this rabbit herpes a second, third, and fourth series of rabbit corneas could be infected. The author proved the existence of very delicate cocci seen with the May-Grünwald-Giemsa stain, but he could not cultivate them. It is now proved that corneal herpes belongs to the filtrable-virus group.

Only the dendritic form, and not the diffuse, patchy, and disciform types of herpetic keratitis, creeps along the nerve fibers. But the ever present hyphesthesia cannot be explained other-

wise than by damage to the nerve fibers. Febrile herpes is dermatropic, whereas herpes zoster is distinctly neurotropic. In 15 percent of infected rabbit corneas there are seen nervous symptoms, excessive salivation, convulsions, trismus, and paresis of the legs, and death occurs within 15 to 18 days; these effects being explainable as due to herpetic encephalitis. Intracerebral injection of herpes virus leads directly to encephalitis, with all the typical symptoms of human lethargic encephalitis. There exists a generalized varicellar zoster with obvious dermatropic rather than neurotropic properties. One type of ophthalmic herpes zoster, herpetic iritis, is clinically restricted to mesodermal tissue.

Soon after the herpes iridis heals there remains an extensive vitiligo iritis, a circumscribed damage to the anterior layer of the iris. Similar vitiligo is found after chickenpox and after smallpox, another proof that the variola and vaccinia viruses are closely related to the herpes virus. Among other virus infections are: epidemic punctate keratoconjunctivitis, trachoma, inclusion conjunctivitis, molluscum contagiosum, and lymphogranuloma venereum. These examples suffice to stress the importance of virus diseases in ophthalmology. R. Grunfeld.

McKee, S. H. Certain virus diseases of the eye. Canadian Med. Assoc. Jour., 1944, v. 50, March, p. 261. (See Section 5, Conjunctiva.)

MacManus, Adeline. Survey of case notes of phlyctenular ophthalmia. Irish Jour. Med. Science, 1943, Nov., pp. 611-612. (See Section 5, Conjunctiva.)

Popov, M. Z. Therapeutic keratoplas-



ty in purulent corneal ulcers. *Viestnik Oft.*, 1942, v. 20, pts. 1-2, p. 40.

Popov's clinical conclusions are: (1) In the majority of cases keratoplasty arrests the progress of serpiginous ulcer, relieves pain, photophobia and hypopyon, and shortens the period of hospitalization. (2) A thin partial transplant takes very well. (3) To obtain a transparent transplant and rapid recovery from the inflammatory process, it is necessary to resect the infiltrated segment completely. The fact that the transplant remains transparent or becomes but slightly opaque indicates that the cells of the transplant exert a definite influence on the processes of proliferation and regeneration. It impedes the development of cicatricial tissue, which is so abundant in the end result of corneal ulcers. (4) There is a marked contrast between the excellent cosmetic effect (from apparent transparency of the transplant) and the low visual acuity. This is probably due to microscopic changes. (5) Keratoplasty is the most effective therapeutic procedure in the treatment of corneal ulcers. How to keep the transplant transparent is one of the problems yet to be solved. (6) Incomplete keratoplasty is a safer surgical procedure than total keratoplasty, but its visual results are poor. Ray K. Daily.

*tem. Arch. Derm. and Syph.*, 1944, v. 49, April, p. 277.

From 12 cases found in the literature and from one of the author's own, the main features clinically of Behcet's syndrome are described as simultaneous or separate attacks of aphthous lesions in the mouth and on the genitalia and ocular changes mostly of the character of a hypopyon iritis. The attacks may or may not begin at the same time, the ocular disorder not rarely developing several years later. Additional symptoms are: erythema-nodosumlike lesions (5 cases); acneform or papulopustular eruption (3 cases); furunclelike pyoderma (1 case); hydrops of the knee (1 case); and cerebral symptoms (2 cases). The predominant age is the third decade; men are twice as frequently affected as women; the course is chronic; prognosis poor, as therapy is of no avail and no instance of healing has been recorded.

In the author's reported case, which showed the classic signs of the syndrome with in addition a furunclelike pyoderma, death occurred after a cerebral attack and necropsy revealed small multiple foci of inflammation and softening in the brain.

Theodore M. Shapira.

## 8

### GLAUCOMA AND OCULAR TENSION

Fialho, Abreu. Studies with the suction cup of Werner Herzau. *Rev. Brasileira de Oft.*, 1943, v. 2, Sept., pp. 19-27. (See Section 2, Therapeutics and operations.)

Hardesty, J. F. The use of doryl in glaucoma. *Amer. Jour. Ophth.*, 1944, v. 27, June, pp. 625-628.

Pokrovsky, A. I. A modification of

## 7

### UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Berlin, C. Behcet's syndrome with involvement of the central nervous sys-

Price, D., and MacManus, A. Report on an investigation into phlyctenular ophthalmia. *Irish Jour. Med. Science*, 1943, Nov., pp. 603-610. (See Section 5, Conjunctiva.)

the Lagrange operation. Viestnik Oft., 1942, v. 20, pts. 1-2, p. 3.

The steps of the operation as done by Pokrovsky are: (1) a conjunctival incision 10 mm. above the limbus, and dissection of the conjunctival flap to the limbus. (2) With a scalpel a scleral incision 7 to 8 mm. is outlined at the edge of the limbus. (3) The incision is extended gradually through the deeper layers of the sclera. (4) With a small cataract knife a semilunar scleral flap is outlined, 2.5 mm. above the incision. (5) This flap is grasped with forceps and dissected obliquely downward toward the limbus, forming a pocket just above the scleral incision. (6) The scleral fibers are carefully cut through and the anterior chamber opened. (7) The scleral incision is completed with scissors. (8) The scleral flap is cut away. (9) Iridectomy is performed. (10) The conjunctival flap is replaced. The merits which the author claims for the procedure are protection of the ciliary body from injury, and consequent absence of postoperative synechia, a flat cicatrix with a thinned sclera, and a subconjunctival fistula covered with thick conjunctiva. (Illustrations.) Ray K. Daily.

## 9

### CRYSTALLINE LENS

Bonfioli, Amelio. Intracapsular extraction of cataract with sclerocorneal suture. *Ophthalmos*, 1943, v. 3, no. 2, pp. 177-186.

The author gives a clear description of his personal technique, with excellent illustrations. The tear sac is washed out with physiologic salt solution. Adrenalin solution is injected subconjunctivally below the lower limbus, to increase dilatation of the pupil in this region and so facilitate grasping

the lens capsule near the lower equator. After fixation of the superior rectus, a variation of the Stallard suture is inserted. Starting through the conjunctiva vertically about 6 mm. above the edge of the loosened flap, the suture is inserted in the sclera 4 mm. from the limbus, is brought out 2 mm. from the limbus, is then carried horizontally through the cornea 1 mm. below the limbus, forming a tunnel of about 2 mm. in the cornea, and is finally carried upward, parallel with the downward arm, through the sclera and out again through the conjunctiva. The corneal incision is made with Graefe knife and scissors. The portion of the suture applied to the cornea is used to raise the corneal flap while the intracapsular extraction is performed, the capsule forceps being carried as far down as possible between the iris and the lens.

W. H. Crisp.

Halbron, Pierre. The physiochemical characteristics of the normal and the pathologic crystalline lens. *Rev. Brasileira de Oft.*, 1942, v. 1, March, pp. 121-139.

This is in the nature of a thesis, and reviews the literature of research with regard to the physical and chemical properties of the crystalline lens, with special reference to the parts played by the following factors in producing lens pathology: calcium and potassium, modification of sugar lipoids (probably more the result than the cause of lens opacity), hydrolysis of the proteins in relation to respiratory disturbances, and acid tendencies of the pH. The author adds a table of the physiochemical characteristics of the lens, and a six-page bibliography. W. H. Crisp.

Rocha, H., and Coscarelli. Anterior lenticonus. *Ophthalmos*, 1943, v. 3, no. 2, pp. 219-225.

In the case reported here, the patient was a white woman aged thirty years. The corneas were regular. In each eye there was a perfectly transparent lenticonus, the skiascopic measurement calling for plus 1.00 sphere at the periphery and minus 10.00 sphere at the center. The base of the lenticonus was 3 to 4 mm. in diameter. There were also a few equatorial opacities of the coronary-cataract type and some filaments of persistent pupillary membrane between the iris and lens. There was no adhesion between the apices of the cones and the posterior surface of the cornea. Conjectures as to the causation are discussed, with brief reference to the literature. (3 illustrations.)

W. H. Crisp.

Salit, P. W. Sugar content of cataractous human lenses. *Amer. Jour. Ophth.*, 1944, v. 27, June, pp. 612-616. (3 tables, references.)

## 10

### RETINA AND VITREOUS

Anfinsen, C. B. Distribution of cholinesterase in the bovine retina. *Jour. Biol. Chem.*, 1944, v. 142, Feb., p. 267. (See Section 19, Anatomy, embryology, and comparative ophthalmology.)

Anfinsen, C. B. Distribution of diphosphopyridine nucleotide in the bovine retina. *Jour. Biol. Chem.*, 1944, v. 152, Feb., p. 279. (See Section 19, Anatomy, embryology, and comparative ophthalmology.)

Barnard, R. I., and Scholz, R. O. Ophthalmoplegia and retinal degeneration. *Amer. Jour. Ophth.*, 1944, v. 27, June, pp. 621-624. (References.)

Coscarelli, Ennio. Coats's retinitis.

*Ophthalmos*, 1943, v. 3, no. 2, pp. 195-204.

After brief preliminary consideration of the subject, the author describes in detail a single case. The patient was a white boy of 12 years. Diminution of vision of the left eye had been noticed for a year or more. This eye was slightly divergent. The anterior segment was normal. The fundus reflex had a greenish tinge. The peripapillary retina had a whitish-yellow color, except in the upper outer quadrant where it was a grayish-green. In the upper and lateral retinal quadrants, yellow areas alternated with dark areas which at many points were almost black. Most of these areas were in the same plane as the normal retina, and were crossed by the clearly visible vessels. In the periphery of the upper outer quadrant, where the fundus had a greenish rosy tint, there was a definite cystic elevation, of the same color. A similar cyst, but less sharply defined, occurred in the upper inner periphery. The vessels had a considerably increased caliber near the disc, but more or less normal caliber in the rest of the fundus. Here and there were seen new-formed anastomotic elevations, the white cords of perivascularitis, and minute scattered hemorrhages. When the patient looked downward, a three-lobed rosy mass became visible, very prominent, and attached in the region of the ora serrata. This mass protruded toward the interior of the eye, occupied the whole inferior quadrant, and even extended into the lateral quadrant. The vessels in the upper region were distended, and generally bordered by yellowish granular bands. The lower region, that of the rosy tumefaction, showed vessels with new-formed capillaries, small hemorrhages, and innumerable small dilatations of a sacular or aneurismic

character. The vision of this eye was limited to counting fingers at about 0.5 meter. The vision of the right eye was normal. Both eyes had normal tension and normal pupillary reflexes. (One color plate, references.) W. H. Crisp.

Michaelson, I. C. Defective night vision among soldiers; dark-adaptation results and their use in diagnosis. *Brit. Jour. Ophth.*, 1944, v. 28, March, pp. 140-147. (See Section 1, General methods of diagnosis.)

Stephenson, W. V. Efficacy of vasodilators in fundus disease. *Amer. Jour. Ophth.*, 1944, v. 27, June, p. 644.

## 11

## OPTIC NERVE AND TOXIC AMBLYOPIAS

Gomes, Brenno. External ophthalmoplegia from crotal (snake) poison. *Ophthalmos*, 1943, v. 3, no. 2, pp. 187-194. (See Section 16, Injuries.)

Singh, Amarjit. A case of neuromyelitis optica (Devic's disease). *Indian Med. Gazette*, 1944, v. 79, Jan., p. 24.

The author gives the history of one case of this disease, a variety of acute disseminated encephalomyelitis characterized by acute onset of paraplegia and optic neuritis. There is no known treatment. In the author's case, death occurred within one week.

W. H. Crisp.

## 13

## EYEBALL AND ORBIT

Ferreira, J. A., and Austregesilo, Jr. Syndrome of Claude Bernard Horner. *Rev. Brasileira de Oft.*, 1943, v. 2, Sept., pp. 39-40.

A single case is recorded by Ferreira,

and is commented upon by Austregesilo from the neurological point of view. The patient was a white child aged nine years. The left eye presented moderate enophthalmos and partial ptosis of the upper lid, and there were also heterochromia and anisocoria. As to each eye the visual acuity, twilight vision, chromatic sense, and peripheral visual field were normal. Dilatation of the left pupil under cocaine or atropine was less than of the right. The neurologic examination showed slight facial asymmetry (the left side of the face being broader than the right), scoliosis, flatfoot, hypotrophy of the muscles of the left hand, hypopigmentation of the nipples, and spina bifida occulta.

W. H. Crisp.

Haik, G. M. Progressive exophthalmos in toxic disease of the thyroid gland. *Arch. of Surgery*, 1944, v. 48, March, p. 214.

The treatment of exophthalmos associated with hyperthyroidism, particularly of the variety which becomes progressive after thyroidectomy, has hitherto been unsatisfactory. Thyroidectomy, far from correcting the condition, frequently seems to aggravate it.

Recent studies indicate that the cause of exophthalmos in hyperthyroidism is local edema, sometimes associated with hypertrophy of the extraocular muscles. The proposal that irradiation be substituted for thyroidectomy is based on the theory that with a less abrupt alteration in the endocrine balance there is a greater chance for more gradual readjustment of the optic structures.

A case of progressive post thyroidectomy exophthalmos is reported and is analyzed in the light of these new concepts. It was unusual because

of the extreme youth and the race (Negro) of the patient.

Theodore M. Shapira.

Kendell, A. M., and Krasnov, M. L. Schüller-Christian disease. *Viestnik Oft.*, 1942, v. 20, pt. 3, p. 69.

The patient, a woman 43 years of age, with negative family and personal history, developed bilateral exophthalmos and lost her teeth. A few years later she began to suffer from extreme thirst, and eight years after onset of the disease she developed inflammatory symptoms of the left eye with an increased exophthalmos. X ray showed absorption of the bones of the skull, and enlargement of the orbit with thinning of its walls. The long bones were not involved, except for the head of the femur, which was deformed and flattened. Exophthalmos, diabetes insipidus, and loss of teeth established the diagnosis of Schuller-Christian disease. The patient was treated with injections of pituitrin, which relieved her headache, thirst, and diuresis. The exophthalmos remained unchanged, but the inflammatory phenomena subsided and vision improved. Ray K. Daily.

Magnus, J. A. Orbital cellulitis in a baby, caused by acute osteomyelitis of the maxilla. *Brit. Jour. Ophth.*, 1944, v. 28, March, pp. 135-138.

The literature is reviewed and the differential diagnosis between osteomyelitis of the superior maxilla and orbital involvement secondary to acute nasal sinusitis is clearly outlined.

A case of orbital cellulitis in a child of two weeks is presented. There was marked edema of the left upper and lower eyelids, with chemosis and proptosis of the eyeball. On the fifth day after admission to the hospital, the child was operated upon. A deep inci-

sion was made through the medial part of the left lower lid, down to the bone. A large subperiosteal abscess in the floor of the orbit was opened and a great amount of pus discharged through the opening. A suction apparatus was used frequently to clear out the discharge from the nose and the incision. The proptosis and swelling of the lids subsided within the next four days, and the temperature returned to normal. The incision in the left lid closed except for a small fistula through which a sequestrum appeared four months after operation. The fistula closed after removal of the sequestrum, and nine months after the operation the scar of the left lower lid was scarcely visible and the child was in perfect health. (5 photographs, references). Edna M. Reynolds.

Paulo, A., Jr. Orbital emphysema as means of radiologic contrast. *Rev. Brasileira de Oft.*, 1943, v. 2, Dec., pp. 85-92.

Four X-ray pictures, a diagram, and a photograph of the patient illustrate this supplemental means of X-ray diagnosis. The patient, a girl of ten years, had slowly progressive exophthalmos on the left side, and a preliminary series of X-ray pictures had failed to give adequate information. Orbital emphysema was produced by retrobulbar injection of about 7 c.c. of air. The exact nature of the (apparently soft) tumor is not stated. Very little absorption of the injected air occurred within 24 hours, and, to relieve the patient's discomfort, the air was released by puncture of the distended conjunctival sac. It is suggested that the air would be better evacuated as soon as the pictures were made.

W. H. Crisp.

Salter, W. T., and Soley, M. H. The treatment of Graves's disease with severe exophthalmos. *Med. Clin. North Amer.*, 1944, v. 28, March, p. 484.

Severe, progressive exophthalmos has been noted most after treatment of hyperthyroidism. Not infrequently, however, this condition may occur during the untreated phase of Graves's disease, making necessary such a measure as supraorbital decompression before thyroidectomy, or irradiation of the thyroid. A small group of patients with Graves's disease will show a persistent and progressive exophthalmos even after adequate treatment of thyrotoxicosis. That hyperthyroidism is only one factor in some cases of Graves's disease is borne out by the finding of a typical Graves syndrome with no hyperthyroid element. It is also suggested in cases in which the hyperthyroidism has been controlled but the Graves's disease persists.

About 40 percent of patients with Graves's disease will show progression of exophthalmos after treatment of their hyperthyroidism. In addition to the usual findings of measurable exophthalmos, photophobia, lacrimation, conjunctival and scleral and occasional lid edema, there may be added diplopia, corneal ulceration, papillitis, and occasional loss of the globe from infection.

Management of exophthalmos is not standardized. One case now reported occurred in Graves's disease without hyperthyroidism, which was controlled by giving large doses of thyroid. The explanation was that thyroid substance inhibited a noxious pituitary substance, the excess of which was responsible for the exophthalmos. In the presence of mild exophthalmos and hyperthyroidism, irradiation of the thyroid, in three courses of 900 r at 6-week intervals, may be used. In the

presence of severe hyperthyroidism, subtotal thyroidectomy is advisable. Any untoward eye symptoms should be carefully watched.

Treatment of the eyes in this condition consists of glasses with side shields for protection, prisms for controllable diplopia, saline eye washes, sulfathiazole ointment for ulceration, suturing of the lids for cosmetic reasons or for corneal protection, and measures to control entropion. Generally papillitis and secondary optic atrophy constitute indications for supraorbital decompression. Exophthalmos preventing closure of the lids is also frequently an indication for decompression. Edema may persist after surgery if it has been delayed too long.

Six to 9 mm. recession of the globe after a temporary postoperative increase in exophthalmos may be expected to follow the Naffziger supraorbital-decompression procedure.

Owen C. Dickson.

## 14

### EYELIDS AND LACRIMAL APPARATUS

Gifford, E. R., Puntteney, I., and Bellows, J. Notes on keratoconjunctivitis sicca. *Trans. Amer. Ophth. Soc.*, 1943, v. 41, p. 80. (See *Amer. Jour. Ophth.*, 1943, v. 26, Dec., p. 1343.)

Hazen, H. H. Dermatitis of eyelids. *Arch. Derm. and Syph.*, 1944, v. 49, April, p. 253.

Acute or chronic dermatitis of the eyelids is common. It may be due to many causes, the commonest of which are seborrheic dermatitis, cosmetics applied to the face, and irritants transferred by the hands, of which nail polish ranks first. Diagnosis is best made by history, from examination of the hands and face, from results of

patch tests, and from information obtained by elimination of suspected substances. Theodore M. Shapira.

Kurlov, I. H. A pocket flap for restoration of the lids. *Viestnik Oft.*, 1942, v. 20, pts. 1-2, p. 12.

The operation is performed at two sittings. In the interim between the two a thin strip of cartilage from the ear is implanted into the flap if it is to be used for the upper lid. The first operation consists in preparing a mucocutaneous flap. An incision 2.5 cm. long is made vertically downward beginning at the outer canthus. The outer lip of the incision is undermined to form a pocket 2 cm. deep. Two parallel incisions are made from the ends of the inner lip of the incision toward the center of the face. There is thus outlined a quadrangular flap of skin, attached at one long end. A piece of mucous membrane from the lip is sutured over the skin with the epithelial surfaces opposed. This double flap is then buried in the previously prepared pocket and held there with sutures. The free end of the mucous membrane is turned over and sutured to the free end of the cutaneous pocket to form the future intermarginal space. The wound is dressed daily and irradiated with a quartz light every other day.

The second operation is performed 15 days later, when the mucous membrane flap has become attached to the outer wall of the pocket. The mucocutaneous flap is cut on a pedicle, to the desired size and form, and is arranged to fill the full thickness defect of the lid. The free end of the mucous membrane is sutured to the remaining conjunctiva of lid or eyeball, and the skin sutures are placed so as to give the flap the contour of the lid.

Ray K. Daily.

Rocha, Hilton. *Molluscum contagiosum*. *Ophthalmos*, 1943, v. 3, no. 2, pp. 212-218.

With some reference to the literature, two cases are reported. A white girl aged seven years, whose right eye for one month had shown congestion, photophobia, and tearing, had warty elevations, about the size of a grain of rice (with depressed yellow centers) one at the external canthus, one at the outer end of the margin of the upper lid, two on the chin, one on the upper lip, and a half dozen in the left axilla. A diagnosis of molluscum contagiosum having been made, the two nodules on the eyelids were curetted and were swabbed with iodine. There was rapid healing of a corneal ulcer which had existed before excision of the nodules. A young white man aged 17 years had a nodule of the same kind in the right upper lid next to the eyelashes. A sulfonamide was prescribed and the nodule excised. Healing occurred under this treatment, and so the author is somewhat disposed to question his diagnosis. (One clinical photograph, 3 photomicrographs.) W. H. Crisp.

Tikhomirov, P. E. Diagnosis of epiphora, *Viestnik Oft.*, 1942, v. 20, pt. 3, p. 34.

This is a detailed discussion of the diagnostic procedures for the etiology of epiphora, with tabulated data of the author's own studies in support of his conclusions. The objective examination consists of the following steps: (1) Inspection of the lids with special attention to the border of the lower lid and conjunctiva, the lacrimal lake, the puncta, and the semilunar fold. (2) The adequacy of the lacrimal canaliculi is tested by instillation of 1-percent fluorescein or 3-percent collargol. If the passages are normal, colored fluid



disappears from the conjunctival sac in one half to two minutes. If this test is negative, the color remains in the conjunctival sac a longer time, indicating disturbance in the function of the lacrimal canaliculi. The action of the canaliculi may be visualized by instilling one to two drops of collargol and immediately illuminating the canaliculi with the slitlamp; the drainage through the canaliculi can be seen as a dark disappearing line. A cotton-wound probe is introduced into the nose two to three minutes after instillation of the stain into the conjunctival sac. The data show that in 85 percent of normal cases the fluid appears under the inferior turbinate within 2 to 5 minutes; only in 14.5 percent of the cases was it delayed for 6 to 10 minutes. (3) If this test is negative and the stain does not appear on the probe, the permeability of the lacrimal passages is determined by probing or irrigation. (4) Stenosis of the lacrimal sac is determined by irrigation; and is localized by X rays with an opaque medium. (5) The examination is completed by examination of the nose, and by search for the cause of functional epiphora, if no organic lesion be found.

The author's investigations lead him to the following evaluation for the canaliculus test; a positive test in one half to one minute indicates excellent suction by the canaliculi; positive within two minutes, good function; delayed to three minutes, impaired function; negative for five minutes, complete lack of function. The test for the presence of colored fluid in the nose is interpreted as follows: Positive within three minutes indicates excellent permeability of the lacrimal passages; after 4 to 6 minutes good permeability; after 7 to 10 minutes, impaired permea-

bility; after 10 minutes markedly impaired permeability; negative for 30 minutes, impermeability. A rapidly positive nasal test is an indication of normally functioning lacrimal passages.

The most reliable method of demonstrating the presence of colored fluid in the nose is to pass a cotton wound probe under the inferior turbinate. The data on Schirmer's test, applied to 46 persons, lead the author to conclude that it is not a reliable criterion of the degree of epiphora. In cases without epiphora the presence of pathology in the nose had no effect on rapidity of lacrimal drainage. Ray K. Daily.

## 15

### TUMORS

Baltin, M. M. Late results of treatment of carcinoma of the lid with Bucky's border rays. *Viestnik Oft.*, 1942, v. 20, pt. 3, p. 63.

This treatment was effective in 35 cases of carcinoma of the lid, a number of which were under observation for a five-year period. Good results are obtained only in superficial growths. If the neoplasm extends into the intermarginal space and the cartilage, the immediate result is good but there is recurrence usually within a year. In six cases, with recurrence the carcinoma extended deeply into the lid. The growth which recurred was much smaller, so that the subsequent surgical procedure was less extensive. Irradiation with these rays is indicated as a prophylactic measure after surgical removal. Treatment with fractional doses is better than irradiation with massive doses. No changes in the lens could be demonstrated in any of the cases observed over a five-year period.

Ray K. Daily.

Pertzeva, V. A., and Levkoeva E. F. Incidence and forms of lid carcinoma. *Viestnik Oft.*, 1942, v. 20, pts. 1-2, p. 55.

A review of the literature and an analysis of 114 tumors seen at the Helmholtz Institute during a ten-year period. Of these 96 were basal-cell carcinomata, and 17 were spinocellular cancers. One case presented a typical picture of adenocarcinoma. In 80.7 percent of the cases the lower lid and inner canthus were involved; in 19.3 percent the upper lid and outer canthus.

Ray K. Daily.

Rocha, H., and Tavares, C. L. Familial characteristic in retinoblastomas. *Opthalmos*, 1943, v. 3, no. 2, pp. 169-175.

A new familial group of cases is reported by the author. The parents were both Portuguese, there was no consanguinity, and there was no knowledge of cases of ocular tumor in the ascendants and collaterals. Of 11 children five had died, two in consequence of retinoblastoma and three from other causes. Excluding these three, the pertinent facts regarding the other eight children are as follows: Two had died from retinoblastoma after removal of the affected eye. Two, aged respectively eight and four years, had been operated upon for retinoblastoma but were still living. Four, aged respectively 14 years, 11 years, 7 years, and 14 months, were in sound health. In all the affected cases the tumor was unilateral.

W. H. Crisp.

## 16

### INJURIES

Arruda, Jonas de. Traumatic fistula of the anterior chamber. *Rev. Brasileira de Oft.*, 1942, v. 1, Dec., pp. 95-98.

A 17-year-old worker in a pin factory was struck in the right eye with a pin which flew from one of the machines used in manufacture. The pin did not adhere to the eye, and in the absence of pain no further attention was paid to the incident. Six months later the patient consulted the ophthalmologist because it had been noticed that this eye did not see so well as the other. The vision of the right eye was reduced to 1/5, while that of the left eye was normal. Examination of the right eye showed the pupil normal and active. There was a filtrating subconjunctival scar occupying the lower inner sector of the bulbar conjunctiva and extending to the cul-de-sac. The slitlamp showed in the corneal epithelium a dystrophic lesion of the dendritic type. Through the conjunctival ectasia could be seen at the five-o'clock position a limbal opening, dark in color, and through which apparently the aqueous was escaping. There was a funnel-shaped elevation of the iris beneath this opening, and adhering to the limbal scar. The tension of this eye was 3 mm., that of the left eye 6 mm. Incidental changes in corneal refraction caused distortion of the ophthalmoscopic view of the fundus. The surgical intervention employed consisted of turning back a conjunctival flap, releasing the anterior synechia, obturation of the minute limbal opening with a small pedicle flap of episclera, and finally suturing of the fistular tissue, the suture being made to include the sclera. Three weeks later the cornea had its normal aspect, the dystrophic disturbance having disappeared, and the corrected vision of the right eye had risen to 1/2. The tension of the affected eye had risen to 12 mm., and that of the other eye to 16 mm. (References.)

W. H. Crisp.

## NEWS ITEMS

Edited by DR. DONALD J. LYLE  
904 Carew Tower, Cincinnati 2

News items should reach the editor by the twelfth of the month

### DEATHS

Dr. Edgar S. Bell, Chicago, Illinois, died April 17, 1944, aged 75 years.

Dr. Jacob F. Burkholder, Chicago, Illinois, died June 7, 1944, aged 82 years.

Dr. Justus B. Chaffin, San Angelo, Texas, died March 21, 1944, aged 67 years.

Dr. Andrew Christensen, Chicago, Illinois, died April 5, 1944, aged 82 years.

Dr. Eugene Dickenshied, Allentown, Pennsylvania, died April 16, 1944, aged 84 years.

Dr. Robert J. Ferguson, New Haven, Connecticut, died May 15, 1944, aged 72 years.

Dr. Albert E. Fritze, Chester, Illinois, died April 6, 1944, aged 83 years.

Dr. Carl Hamburger, born in 1870, died in May, 1944, in Gland near Geneva, Switzerland. His studies in the physiology of nutrition of the eye, of problems concerning glaucoma were among his most important. His "Theoretical and practical notes on glaucoma" were published in this Journal (October, 1930). Doctor Hamburger practiced in Berlin from 1898 until 1939, when he was forced to leave; he found refuge in Switzerland.

Dr. Ralph A. Hatch, Boston, Massachusetts, died April 1, 1944, aged 62 years.

Dr. Harry M. Ivins, Santa Cruz, California, died March 21, 1944, aged 65 years.

Dr. Charles M. Mooney, Columbus, Ohio, died March 24, 1944, aged 73 years.

Dr. Hans Paulsen, Chicago, Illinois, died April 11, 1944, aged 58 years.

Dr. Edward H. Porter, Tiffin, Ohio, died May 14, 1944, aged 71 years.

Dr. Albert Thompson, Saint James, Minnesota, died March 10, 1944, aged 71 years.

Dr. Arthur D. Whiting, Saint Cloud, Minnesota, died March 19, 1944, aged 71 years.

### MISCELLANEOUS

The Leslie Dana Gold Medal, awarded annually for outstanding achievements in the prevention of blindness and the conservation of vision, will be presented this year to Miss Linda Neville of Lexington, Kentucky, it has been announced by the National Society for the Prevention of Blindness. Miss Neville is the

founder of the Kentucky Society for the Prevention of Blindness. Selection of the recipient of the Leslie Dana Gold Medal is made by the Saint Louis Society for the Blind, through which the medal is offered by Mr. Leslie Dana of Saint Louis. This highly prized token of recognition in the field of public health is given upon the recommendation of the Association for Research in Ophthalmology.

### SOCIETIES

A joint meeting of the Reading, Pennsylvania, Eye, Ear, Nose, and Throat Society and the Reading Dental Society was held June 22, 1944. The speaker was Lt. Col. James B. Brown, Chief of the Plastic Center of Valley Forge General Hospital. His topic was "Military plastic surgery" and his talk was illustrated with slides and motion pictures.

At the recent annual meeting of the Florida Medical Association Dr. Shaler Richardson of Jacksonville was chosen president-elect.

Among the speakers at the meeting of the Fifth Councilor District Medical Society held on May 16th in Magnolia, Arkansas, was Dr. Wiley R. Buffington, New Orleans, who spoke on "Certain ocular manifestations resulting from systemic diseases."

### PERSONALS

Lt. Col. E. O'G. Kirwan, professor of ophthalmology in the Calcutta Medical College, retired in May, 1944 and, according to a recent communication from a colleague in India, he expects to proceed to America. His address will be: Lt. Col. E. O'G. Kirwan, C.I.E., I.M.S., 800 South West Vista Avenue, Portland, Oregon.

Dr. Kenneth C. Swan, for the past five years connected with the medical department of the University of Iowa, has been made Associate Professor of Ophthalmology at the University of Oregon Medical School, effective July 10, 1944.

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## CHOLINE ESTERS WITH MYDRIATIC AND CYCLOPLEGIC ACTION\*

KENNETH C. SWAN, M.D., AND NORMAN G. WHITE, M.S.

*Iowa City, Iowa*

Before a previous meeting of this Society, the authors<sup>1</sup> reported that the corneal penetration of drugs was profoundly affected by their physical properties. For example, the onset and intensity of corneal anesthesia induced by a group of topical anesthetics could be correlated with their surface activity. It was conceived that modifications in physical properties might likewise intensify or even alter the ocular effects of autonomic drugs. Choline esters were the first autonomic drugs so modified.<sup>2</sup> Some of the results are reported herein.

The most characteristic action of previously known choline esters is stimulation of structures innervated by the parasympathetic nervous system; for example, the ocular effects of acetylcholine are miosis and spasm of accommodation resulting from stimulation of the iris sphincter and ciliary muscles. Many other choline esters have been synthesized, but in their preparation emphasis was placed on the development of more stable and potent compounds than acetylcholine, such as carbamylcholine. The possibility of reversing the characteristic action of acetylcholine did not receive consideration. Moreover, no attempts were made to

correlate the pharmacologic action and the physical properties of the choline esters prior to this investigation.

The physical properties of organic molecules are determined by the characteristics and interrelationships of their component chemical groups. Choline contains a dominant quaternary ammonium group which has a very high affinity for water; consequently, choline and acetylcholine salts (fig. 1) are hygroscopic and relatively surface inactive. A review of the literature revealed no simple choline esters in which the highly hydrophilic quaternary ammonium group had been counteracted or balanced by addition of a large hydrophobic group to the molecule. Investigation of this possibility necessitated synthesis of a new compound in which the highly water-soluble choline group was combined through an ester linkage to a large water-insoluble hydrocarbon group. The resultant elongated molecules would be expected to orient themselves at the surfaces of water solutions and thereby lower surface tension (fig. 2). Such surface-active molecules penetrate living cells rapidly, alter cellular permeability, induce alterations in enzyme systems, and otherwise profoundly influence cellular physiology. Therefore, conversion of a choline ester from a surface-active compound would be expected to influence its pharmacologic action.

Carbamylcholine (doryl), most potent and stable of previously known simple

\*From the Department of Ophthalmology, College of Medicine, State University of Iowa. Part of a study being conducted under a grant from the John and Mary R. Markle Foundation. Read at the fourteenth scientific meeting of The Association for Research in Ophthalmology, at Chicago, June 13, 1944.

choline esters, was selected for the initial conversion to a surface-active compound. The hydrophilic  $\text{NH}_2$  group was replaced by a water-insoluble group, di-butylamine

tail elsewhere.<sup>3</sup> The new drug produces mydriasis by inhibition of the iris sphincter, and also recession of the near point of accommodation. Its effects on the intra-

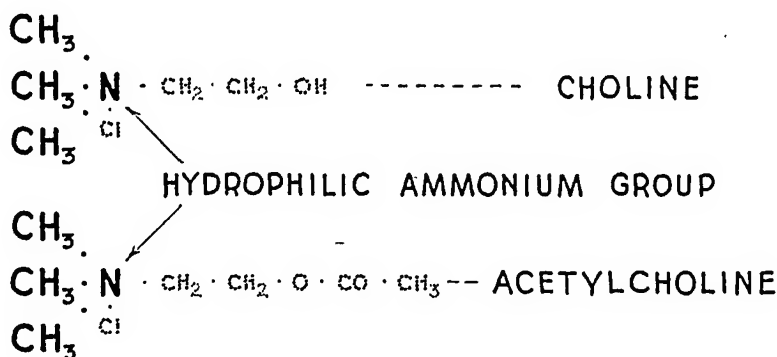


Fig. 1 (Swan and White). Dominant hygroscopic groups in choline and acetylcholine.

(fig. 3). The resultant surface-active compound, di-n-butyl-carbamylcholine chloride, was found to have ocular effects the reverse of those of carbamylcholine. Whereas carbamylcholine produced miosis and spasm of accommodation, the new drug produced mydriasis and cycloplegia.

The ocular pharmacology of di-n-butyl-carbamylcholine has been reported in de-

ocular muscles, therefore, simulate oculomotor nerve paralysis. Miosis and spasm of accommodation induced by eserine, pilocarpine, and carbamylcholine are effectively antagonized. Di-n-butyl-carbamylcholine has little effect on the extraocular muscles of mammals or on the iris muscles of birds which are of the striate type. Likewise, the smooth muscle

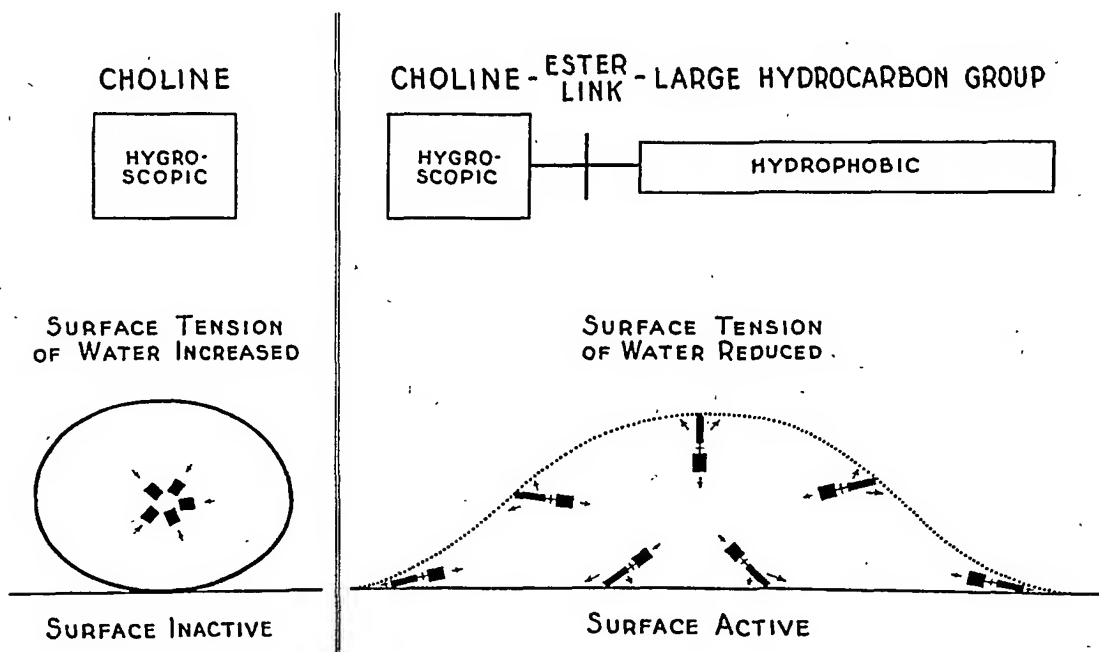
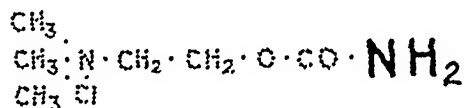


Fig. 2 (Swan and White). Structure and mode of action of surface-active choline esters.

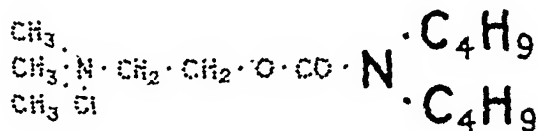
of the lid and the iris dilator fibers, both innervated by the sympathetic nervous system, are unaffected.

The exact site of action of the new drug has not yet been determined; however, there is evidence that its major action is peripheral; that is, upon either the nerve endings or muscle cells. Retrobulbar injections of di-n-butyl-carbamyl-

addition of butyl groups is not a dosage phenomenon. Even in threshold concentrations in the aqueous humor, mydriasis produced by di-n-carbamylcholine is not preceded by miosis. Moreover, di-n-butyl-carbamylcholine is not chemically related to previously known drugs with mydriatic and cycloplegic action; for example, the atropine series. Therefore, it must repre-



## CARBAMYLCHOLINE



## DI-n-BUTYL-CARBAMYLCHOLINE

Fig. 3 (Swan and White). Substitution of a water-insoluble amine for the hydrophilic  $\text{NH}_2$  group in carbamylcholine (doryl).

choline result in prompt mydriasis in living cats and rabbits; however, retrobulbar injections made immediately after cessation of the circulation\* have little effect on the pupil, although intracorneal injections still produce some mydriasis. Therefore, it is probable that mydriasis following retrobulbar injections results from the drug being carried to the intraocular muscles by the ciliary vessels rather than from action of the drug upon the ciliary nerves and ganglion.

From these experiments it is evident that the new drug has the same general site of action as have previously known choline esters, but its effects are opposite. This reversal of action of carbamylcholine by the addition of hydrophobic groups is unprecedented in autonomic pharmacology. Several autonomic drugs, notably nicotine, produce stimulation in small doses and depression in large, but the reversal of action of carbamylcholine by

sent a new class of autonomic drugs.

To determine the most effective member of the new class as well as to correlate pharmacologic action with chemical structures and physical properties, a number of compounds closely related to di-n-butyl-carbamylcholine were synthesized by the authors. The di-butylamine group was replaced by other aliphatic amines of varying size and affinity for water. As shown in table 1, the surface-active derivatives were mydriatics and cycloplegics whereas carbamylcholine (doryl) and its surface-inactive derivatives were miotic and cyclotonic drugs. The di-propyl-amine derivative was intermediate in surface activity and had little pharmacologic activity. In a second series of new compounds, aromatic hydrocarbon groups rather than simple carbon chains were substituted for the butyl groups. Again the surface-active compounds were mydriatics and cycloplegics whereas the surface inactive compounds were mydriatics and cyclotonic drugs (table 2). In both series balancing of the hydrophilic quater-

\* Cessation of circulation was determined by examination of the retinal and conjunctival vessels.

ary ammonium group in choline with a hydrophobic group of sufficient size to effect a marked increase in surface activity seemed essential for mydriatic and cycloplegic action. Rather than the addition of a specific chemical group, substitution of any water-insoluble amine for the hydrophilic  $\text{NH}_2$  group in carbamylcholine (doryl) seemed effective.

mate end of the molecule was not altered. As shown in table 3, replacing one of the methyl groups in di-n-butyl-carbamylcholine by an ethyl group increased both surface and pharmacologic activity of the compound. This compound, dibutoline, proved to be the most effective of the new class of drugs. When the methyl groups at the choline end of di-n-butyl-carbamyl-

TABLE 1  
CHEMICAL STRUCTURE, SURFACE TENSION, AND PHARMACOLOGIC ACTION  
OF ALIPHATIC DERIVATIVES OF CARBAMYLCHOLINE

COMPOUND	STRUCTURE			SURFACE TENSION OF 5% AQUEOUS SOL. DYNES PER CM. 25°C.	PHARMACOLOGIC ACTION
	CHOLINE SALT	ESTER LINK	AMINE AND ITS SOLUBILITY		
CARBAMYLCHOLINE (DORYL)	$(\text{CH}_3)_3\text{N}^+\cdot(\text{CH}_2)_2\text{Cl}^-$	$\text{O}=\text{C}\cdot$	$\text{N}\cdot\begin{matrix} \text{H} \\ \text{H} \end{matrix}$ (WATER SOLUBLE)	RELATIVELY SURFACE INACTIVE	STRONG MIOTIC
DIMETHYL-CARBAMYLCHOLINE	"	"	$\text{N}\cdot\begin{matrix} \text{CH}_3 \\ \text{CH}_3 \end{matrix}$ (WATER SOLUBLE)		MIOTIC
DIETHYL-CARBAMYLCHOLINE	"	"	$\text{N}\cdot\begin{matrix} \text{CH}_2\cdot\text{CH}_3 \\ \text{CH}_2\cdot\text{CH}_3 \end{matrix}$ (WATER SOLUBLE)		WEAK MIOTIC
DIPROPYL-CARBAMYLCHOLINE	"	"	$\text{N}\cdot\begin{matrix} (\text{CH}_2)_2\cdot\text{CH}_3 \\ (\text{CH}_2)_2\cdot\text{CH}_3 \end{matrix}$ (SLIGHTLY WATER SOLUBLE)		INACTIVE
DIBUTYL-CARBAMYLCHOLINE	"	"	$\text{N}\cdot\begin{matrix} (\text{CH}_2)_3\cdot\text{CH}_3 \\ (\text{CH}_2)_3\cdot\text{CH}_3 \end{matrix}$ (WATER INSOLUBLE)	SURFACE ACTIVE	STRONG MYDRIATIC AND CYCLOPLEGIC
BUTYL-AMYL-CARBAMYLCHOLINE	"	"	$\text{N}\cdot\begin{matrix} (\text{CH}_2)_3\cdot\text{CH}_3 \\ (\text{CH}_2)_4\cdot\text{CH}_3 \end{matrix}$ (WATER INSOLUBLE)		MYDRIATIC AND CYCLOPLEGIC
DIAMYL-CARBAMYLCHOLINE	"	"	$\text{N}\cdot\begin{matrix} (\text{CH}_2)_4\cdot\text{CH}_3 \\ (\text{CH}_2)_4\cdot\text{CH}_3 \end{matrix}$ (WATER INSOLUBLE)		MYDRIATIC AND CYCLOPLEGIC

To study further the apparent relationship between physical properties and pharmacologic action of the choline esters a third series of compounds was synthesized in which surface activity was varied by modification made at the choline rather than at the carbamate end of the molecule. The hydrophilic properties of the quaternary ammonium group were varied while the hydrophobic character of the carba-

choline were otherwise replaced by ethyl, propyl, or butyl groups, surface activity and pharmacologic potency were reduced. The hydrophilic character of the ammonium end of the molecule was also reduced by substituting di-ethyl and dimethyl groups in place of the tri-methyl (fig. 4). These tertiary amines were less surface active, and their mydriatic and cycloplegic actions weaker than those of



TABLE 2  
CHEMICAL STRUCTURE, SURFACE ACTIVITY, AND PHARMACOLOGIC ACTION  
OF AROMATIC DERIVATIVES OF CARBAMYLCHOLINE

COMPOUND	STRUCTURE			SURFACE TENSION OF 5% AQUEOUS SOL. DYNES PER CM. 25°C.		PHARMACOLOGIC ACTION
	CHOLINE SALT	ESTER LINK	AMINE AND ITS WATER SOLUBILITY			
PIPERIDINE DERIVATIVE	$(\text{CH}_3)_3\text{N}^+\cdot(\text{CH}_2)_2\text{Cl}^-$	$\text{O} \cdot \text{C} \cdot$	$\begin{array}{c} \text{CH}_2-\text{CH}_2 \\ \text{H} \quad \quad \text{CH}_2 \\ \text{CH}_2-\text{CH}_2 \end{array}$ (HIGHLY WATER SOLUBLE)	SURFACE INACTIVE	61	MIOTIC
PHENYL-CARBAMYLCHOLINE	"	"	$\begin{array}{c} \text{H} \cdot \text{C}_6\text{H}_5 \\ \text{H} \end{array}$ (WATER SOLUBLE)	SURFACE INACTIVE	60	MIOTIC
DIPHENYL-CARBAMYLCHOLINE	"	"	$\begin{array}{c} \text{H} \cdot \text{C}_6\text{H}_5 \\ \text{H} \cdot \text{C}_6\text{H}_5 \end{array}$ (WATER INSOLUBLE)	SURFACE ACTIVE	42	MYDRIATIC AND CYCLOPLEGIC
DIBENZYL-CARBAMYLCHOLINE	"	"	$\begin{array}{c} \text{CH}_2 \cdot \text{C}_6\text{H}_5 \\ \text{H} \cdot \text{CH}_2 \cdot \text{C}_6\text{H}_5 \end{array}$ (WATER INSOLUBLE)	SURFACE ACTIVE	48 SATURATED SOL (LESS THAN 3%)	MYDRIATIC AND CYCLOPLEGIC

TABLE 3  
CHANGES IN SURFACE ACTIVITY AND MYDRIATIC ACTION RESULTING FROM  
MODIFICATIONS IN THE QUATERNARY AMMONIUM GROUP

COMPOUND	STRUCTURE		SURFACE TENSION OF 5% AQUEOUS SOL. DYNES PER CM. 25°C.	COMPARATIVE MYDRIATIC ACTION (RABBIT)
DI-n-BUTYL-CARBAMYLCHOLINE	$\begin{array}{c} \text{CH}_3 \backslash \\ \text{CH}_3 \cdot \\ \text{CH}_3 / \end{array}$	$\text{N}^+(\text{CH}_2)_2 \cdot \text{O} \cdot \text{C} \cdot \text{N}^+ \begin{array}{c} \text{C}_4\text{H}_9 \\ \text{C}_4\text{H}_9 \end{array}$	40	+++
DIMETHYL-ETHYL-DERIVATIVE (DIBUTOLINE)	$\begin{array}{c} \text{CH}_3 \backslash \\ \text{CH}_3 \cdot \\ \text{C}_2\text{H}_5 / \end{array}$	"	36	++++
DIETHYL-METHYL-DERIVATIVE	$\begin{array}{c} \text{C}_2\text{H}_5 \backslash \\ \text{C}_2\text{H}_5 \cdot \\ \text{CH}_3 / \end{array}$	"	41	+++
TRIETHYL-DERIVATIVE	$\begin{array}{c} \text{C}_2\text{H}_5 \backslash \\ \text{C}_2\text{H}_5 \cdot \\ \text{C}_2\text{H}_5 / \end{array}$	"	41	+++
TRIBUTYL-DERIVATIVE	$\begin{array}{c} \text{C}_4\text{H}_9 \backslash \\ \text{C}_4\text{H}_9 \cdot \\ \text{C}_4\text{H}_9 / \end{array}$	"	56	±
DIMETHYL-PROPYL-DERIVATIVE	$\begin{array}{c} \text{CH}_3 \backslash \\ \text{CH}_3 \cdot \\ \text{C}_3\text{H}_7 / \end{array}$	"	43	++



bamate group probably results from its inhibitory action on choline esterases;<sup>4</sup> consequently, carbamic acid esters of choline are more stable and, therefore, more potent than esters like acetylcholine which are rapidly hydrolyzed in the tissues. The latter have only fleeting action.

Dibutoline, the most effective of the new class of drugs, is relatively surface

the former are irritating when instilled into the conjunctival sac, whereas single instillations of the sulfate salt are well tolerated. No difference has been noted in pharmacologic activity of the different salts, probably owing to the fact that in the intraocular tissues dibutoline exists in minute concentrations, and therefore, is highly ionized. The ocular pharma-

TABLE 4  
SURFACE ACTIVITY AND DEGREE OF CONJUNCTIVAL IRRITATION PRODUCED  
BY AQUEOUS SOLUTION OF VARIOUS DIBUTOLINE SALTS

DIBUTOLINE SALT	SURFACE TENSION OF 5% AQUEOUS SOL. DYNES PER CM. 25°C	CONJUNCTIVAL IRRITATION FROM SINGLE INSTILLATIONS OF 5% SOLUTIONS
IODIDE	36	++
CHLORIDE	39	++
METHYL SULFATE	45	+
SULFATE	47	±

active in ionic form. Surface-active drugs penetrate the cornea readily and have antibacterial action; however, high concentrations or repeated instillations produce conjunctival irritation and punctate disturbances of corneal epithelium.<sup>5</sup> For clinical purposes, it was desirable to find a salt of dibutoline which would be only partially ionized in therapeutic concentrations and therefore less apt to cause conjunctival irritation. It was found that whereas the 5-percent solutions of the chloride salt of dibutoline were almost completely ionized and had an interfacial tension of 36 dynes per cm. at 25°C., equimolecular solutions of a double salt, the sulfate, were only partially ionized and had an air-water interfacial tension of 47 dynes (table 4). Five-percent solutions of

cology and clinical use of dibutoline sulfate are reported in detail elsewhere.<sup>6</sup>

#### DISCUSSION

The discovery of an apparent relationship between the pharmacologic action and physical properties of the carbamylcholine series may provide a basis for the development of other new therapeutic agents. Therefore, a theoretical discussion of the possible mode of action of the new class of drugs is of practical importance. The most plausible theory is that the new drugs act as "inhibitory analogues" of acetylcholine. An "inhibitory analogue" is a compound which, by virtue of its chemical similarity to a normal metabolite, replaces the latter in the tissues but is incapable of fulfilling its meta-

bolic functions; consequently, physiologic functions dependent upon the presence of the normal metabolite are interrupted. There are numerous examples in bacterial metabolism, notably para-aminobenzoic acid and para-amino-benzene-sulfonamide (sulfanilamide.<sup>7</sup>) The latter is thought to inhibit the multiplication of certain bacteria by competing with the normal metabolite, para-amino-benzoic acid, for enzymes essential for growth. A similar relationship may exist between the new series of cholinergic esters and acetylcholine. Acetylcholine normally is involved in the mediation of nerve impulses to tissues like the iris sphincter and ciliary muscles. The new compounds are chemically similar to acetylcholine but are surface active and, therefore, would be expected to have the greater affinity for the tissues. If the new drugs displaced acetylcholine from the muscle-receptor system but were incapable of fulfilling its role in the normal transmission of nerve impulses, relaxation of the involved muscle would result.

#### SUMMARY AND CONCLUSIONS

Balancing of the hydrophilic quaternary ammonium group in carbamylcholine (doryl) with hydrophobic carbon groups results in a reversal of its pharmacologic

action on the intraocular muscles. Whereas carbamylcholine (doryl) produces miosis and cyclotonia, di-n-butyl-carbamylcholine produces mydriasis and cycloplegia. Correlation of physical properties with the pharmacologic action of other new drugs synthesized by the authors indicates that the unique reversal of action of carbamylcholine seems dependent upon its conversion to a surface-active compound. The surface-active carbamylcholine derivatives have a potent peripheral antispasmodic action on the smooth muscles of the eye innervated by the parasympathetic nervous system; that is, the iris sphincter and ciliary muscles. The mydriatic and cycloplegic effects of other surface-active choline esters are considerably weaker.

The surface-active carbamylcholine derivatives are chemically unrelated to previously known mydriatic and cycloplegic agents—for example, the atropine series—and, therefore, constitute a new class of drugs. For clinical purposes the sulfate appears to be the most satisfactory salt and dibutoline the most effective member of the new class. It is suggested that the new drugs may act as "inhibitory analogues" of acetylcholine.

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# A QUANTITATIVE TEST FOR MEASURING DEGREE OF RED-GREEN COLOR DEFICIENCY\*

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The types of color-vision test needed for the classification of Air Force personnel are (1) a simple, rapid, and reliable screening test that will distinguish the normal from the color-deficient applicants, and (2) a supplementary quantitative test that will classify the latter group as to the degree of defect, and will be of aid in determining whether the applicant is competent to make the color discriminations required in his particular job.

The Color-Threshold Tester was devised for use as such a supplementary test. Since recognition of colored-light signals is generally considered to be among the most important and most difficult of the color discriminations required of air-crew members, a color-naming test was developed that would involve ability to recognize colored lights of low intensity subtending small visual angles.

The colors used in airport beacons, airway-course lights, airport-boundary and strip lights, traffic-control projectors, obstruction lights, approach lights, and so forth, must meet the specifications set by the Bureau of Standards for Aviation Colors. The allowable variation in hue and saturation is defined in terms of standard "limit glasses" used in combination with a standard light source. To stimulate in a test the conditions involved in the recognition of colored-light signals, the test lights should be of high purity and should differ markedly in dominant wave-length. They should, how-

ever, be of low intensity and subtend a small visual angle.

The Color-Threshold Tester consists essentially of the following parts: (1) a 60-watt lamp enclosed in a lamp house, (2) a diffusing milk-glass surface illuminated to the desired brightness by adjustment of the distance of the lamp from the surface, (3) a disc containing three apertures for varying the size of the test field, (4) a disc with eight apertures containing neutral filters for varying the brightness of the test field, (5) a disc with eight apertures containing color filters for varying the color of the test field, (6) guide lights located on either side of the test field for controlling fixation.

The aperture disc contains three circular openings one-eighth, one-fourth, and one inch in diameter. When the subject is 10 feet from the lantern, the smallest aperture subtends a visual angle of 3 minutes, 40 seconds. (If the tests are made at a distance of 20 feet, the one-fourth inch aperture is used. The one-inch aperture is used only in calibrating the instrument.) Two small holes drilled in the front of the lamp house at  $2\frac{1}{2}$  inches from the test field on the right and on the left, covered with blue gelatine filters (Wratten No. 46), provide tiny blue lights which serve as guide lights for controlling fixation. They also serve to orient the lantern properly with respect to the subject, because if the lantern is turned away appreciably one or the other of the guide lights will be hidden.

The intensity disc contains Wratten neutral filters of the following densities: 2.1, 1.8, 1.5, 1.2, 0.9, 0.6, 0.3, 0.0. By

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means of this disc the brightness of the test field can be varied over a range of 2.1 log units in steps of 0.3 log unit. Each successive brightness level is, therefore, double the preceding one.

Test lights of eight different colors are used: two reds, two yellows, two greens, a blue, and a white. The choice of filters for these colors was based principally on two considerations: (1) They should provide colors close to the limiting standards for Aviation Colors, since these are the more difficult for both normal and color-deficient subjects; (2) they should include colors of particular difficulty for the color-deficient subject. Although red-green color-deficient persons probably see the blue, yellow, and white lights essentially as they appear to the normal, it is important that they be included, because their presence makes the correct naming of red and green more difficult for the color-deficient subjects. One of the reds used in the instrument approximates the yellow limit of Aviation Red, which may be difficult to distinguish from a reddish yellow; the other is a longer wave-length red, which at low intensity may not be visible at all to the protanopic type of the color deficient. The two greens and the two yellows used are within, but close to, the "limiting" Aviation Colors. The blue is within, but close to, the green limit for Aviation-Blue. The white light is close to the blue limit for Aviation White. In a test in which the color-deficient individual is required to name colors, it is particularly important to include a white light, because confusion of green and white is characteristic of this group and because they more frequently call a white light green than they call a green light white. Blue is seldom used as a signal or recognition light at the present time, and at low intensities is easily confused with green even by those with normal color vision. It has been included, however, in

order to make the test a more complete and more fundamental measure of color discrimination.

The minimum intensity at which each of the eight test lights is shown is so chosen that all but a small percentage of those with normal color vision can identify the color at this level of intensity. At the lowest level of intensity, therefore, the eight colors are of approximately equal *difficulty* insofar as recognition of the color is concerned, but are not of equal intensity. The intensities of the eight colors at the second level are double the minimum values and are, therefore, again approximately equal to one another in "difficulty" but not in intensity. At each succeeding level the brightnesses are increased by 0.3 log unit.

#### PROCEDURE

The test is made in a dark room. The subject is first shown the eight colors at the highest level of intensity by placing the intensity control wheel at level No. 8. The color wheel is started at No. 8 and turned clockwise. As the colors are shown, they are named by the operator as green, white, red, yellow, blue, green, orange or amber, and red. The subject is told that he must use only these terms in naming the colors to be shown him. He is instructed to look midway between the two guide lights. The intensity control is then set at level No. 1 by turning it one step clockwise, and the eight colors from No. 1 to No. 8 are shown at this level. The intensity control is then shifted to level No. 2 and the eight colors are shown in the reverse order from No. 8 to No. 1. The operator proceeds in this manner until all eight colors have been shown at each of the eight levels of intensity. It has been found that no preliminary period of dark adaptation is required other than the minute or so taken in explaining the procedure and showing the colors at the

highest intensity, *unless* the subject has just come in from out-of-doors.

### METHOD OF SCORING

Table 1 shows a series of typical records for color-deficient subjects with various degrees of defect. It will be seen that the errors characteristic of the color-deficient group are confusion of green with white, amber with red, and failure

to see the red light at all at low intensities. Both normal and color-deficient subjects, on the other hand, confuse blue with green in this test, yellow with white, and amber with yellow. Color-deficient subjects frequently name a color correctly in the middle range of intensities and yet make characteristic errors at higher intensities. This may be due to chance guessing of the correct answer, but is probably also

TABLE 1  
TYPICAL RECORDS ON COLOR-THRESHOLD TESTER

I								
	1r	2a	3g	4b	5y	6r	7w	8g
1	—	r	b	—	r	r	r	w
2	y	y	w	w	y	r	w	w
3	y	y	g	g	y	r	y	g
4	r	y	g	g	y	r	y	g
5	r	y	g	g	y	r	w	g
6	r	o	g	g	y	r	y	g
7	r	o	g	b	o	r	w	g
8	r	o	g	b	o	r	w	g
Score 52	5	7	6	6	7	8	7	6
Answers counted correct	r	o	g	b	y	r	w	g
		a	b	g	w		y	b
		y			a			
					o			

II								
	1r	2a	3g	4b	5y	6r	7w	8g
1	r	y	g	r	y	r	w	g
2	r	y	w	b	y	r	y	g
3	r	y	g	b	y	r	y	g
4	r	y	w	r	y	r	w	g
5	r	y	g	g	y	r	g	g
6	r	y	g	g	y	r	y	w
7	r	y	g	b	y	r	w	g
8	r	y	g	b	y	r	g	w
Score 40	8	8	4	4	8	8	0	0

III								
	1r	2a	3g	4b	5y	6r	7w	8g
1	—	g	b	—	g	—	b	—
2	b	w	g	b	g	—	w	b
3	g	w	b	b	g	b	w	g
4	b	o	g	b	w	g	w	g
5	g	o	b	b	o	g	w	b
6	r	o	g	b	o	r	w	w
7	r	o	g	b	o	r	g	g
8	r	o	g	b	o	r	w	g
Score 34	3	5	8	7	5	3	1	2

IV								
	1r	2a	3g	4b	5y	6r	7w	8g
1	b	r	b	g	a	g	g	b
2	b	a	w	b	y	g	a	w
3	g	y	w	g	r	r	w	a
4	g	r	w	b	y	r	r	w
5	y	y	g	b	y	r	a	w
6	r	r	w	b	r	r	w	y
7	a	r	b	b	r	r	w	w
8	a	r	w	b	r	r	w	w
Score 17	0	0	0	8	0	6	3	0



due in part to the fact that the color deficient associate certain brightnesses with certain color names.

The method of scoring adopted was chosen after considerable experience with the test, because it gives the highest reproducibility of scores in repeated tests and the greatest differentiation between the scores of normal and color-deficient subjects. The answers which are counted correct for each color are shown in Record I in Table 1.\*

The numerical score is obtained as fol-

intensities; this is in accord with practical considerations, since errors in recognition of colors of higher intensity are more serious in actual practice. This method of scoring also takes into account the characteristic differences in the responses of normal and color-deficient subjects. It was found that if the test is scored by simply counting the total number of errors, it does not provide so efficient a means of differentiating these two groups as when it is scored in the manner described.

TABLE 2

DISTRIBUTION OF SCORES ON COLOR-THRESHOLD TEST FOR NORMAL AND COLOR-DEFICIENT SUBJECTS

Scores	Percent of Cases		Score Equal To Or Greater Than	Percent of Cases	
	200 Normals	209 Color Deficient		200 Normals	209 Color Deficient
64-60	95.0	12.0	60	95.0	12.0
59-55	4.5	12.4	55	99.5	24.0
54-50	0.5	12.4	50		37.0
49-45	0.0	12.4	45		49.0
44-40		16.3	40		66.0
39-35		11.5	35		77.0
34-30		9.6	30		87.0
29-25		5.3	25		92.0
24-20		3.4	20		95.0
19-15		3.4	15		98.5
14-10		1.0			
9 or less		0.5			

lows: The part score for each of the eight test lights is obtained by counting the correct responses starting from intensity level No. 8 and continuing to lower intensities until an error occurs. *Correct responses at still lower levels are not counted.* The score for the entire test is the sum of the eight part scores.

The method of scoring in which correct responses at lower levels of intensity are not counted when an error is made at a higher intensity puts a greater penalty on mistakes made at high than at low

Table 2 shows the distribution of scores of 200 normal and 209 color-deficient subjects. It may be seen that 95 percent of the normal group and 12 percent of the color-deficient group make scores of 60 or better. The scores of the remaining 88 percent of the color-deficient group range from 59 to 9.

In order to determine the reproducibility of the scores, 98 color-deficient subjects were given two independent tests. In 58 cases the second test was given immediately after the first, in 43 cases the two tests were made on different days. The results are summarized in table 3, which shows the mean scores, the standard deviations, and the test-retest correlation. In interpreting these values, it should be remembered that the scores

\*It might be thought that since blue may be called green, white called yellow, and so on, the test could be simplified by the omission of some of the colors. It is probable, however, that reduction in the number of colors used would make the test less satisfactory in differentiating degrees of defective color perception.

TABLE 3  
TEST-RETEST RESULTS ON COLOR-THRESHOLD TEST FOR 98 COLOR-DEFICIENT SUBJECTS

	No. of Cases	Mean Score Test 1	Mean Score Test 2	Standard Deviation Test 1	Standard Deviation Test 2	Correlation Coefficient
Two tests Same session	55	44.2	44.9	14.4	14.7	plus 0.94
Two tests Different days	43	45.3	45.8	12.1	10.1	plus 0.80

on this test do not show a normal distribution. The mean scores in the two tests show no evidence of improvement due to practice, whether the second test is given immediately after the first or on another day.

It is of interest to know the extent

to which the scores on this test are related to scores on tests measuring other aspects of color discrimination. One hundred color-deficient subjects given the Color-Threshold Test were also given five other color-vision tests; namely, (1) a modified RCN Lantern, (2) a short-

TABLE 4  
RELATIONSHIP BETWEEN SCORES OF VARIOUS TESTS (100 COLOR-DEFICIENT SUBJECTS)

		Score, Color-Threshold Test				Number with Same Grade on Both Tests	
		64-53	52-40	39-18		Observed	Expected on Basis of Chance
Errors Canadian Lantern	<div> <div>0-5</div> <div>6-8</div> <div>9 or more</div> </div>	<div>23</div> <div>8</div> <div>1</div>	<div>7</div> <div>13</div> <div>15</div>	<div>1</div> <div>10</div> <div>22</div>	<div>31</div> <div>31</div> <div>38</div>	58	33.3
Errors Simplified Farnsworth Test	<div> <div>0</div> <div>1-4</div> <div>5 or more</div> </div>	<div>20</div> <div>10</div> <div>2</div>	<div>10</div> <div>16</div> <div>9</div>	<div>5</div> <div>10</div> <div>18</div>	<div>35</div> <div>36</div> <div>29</div>	54	33.4
Errors Abridged A.O.	<div> <div>4-12</div> <div>13-15</div> <div>16-17</div> </div>	<div>20</div> <div>5</div> <div>7</div>	<div>10</div> <div>13</div> <div>12</div>	<div>4</div> <div>11</div> <div>18</div>	<div>34</div> <div>29</div> <div>37</div>	51	33.2
		32	35	33			

		Score, Color-Threshold Test					
		64-57	56-35	34-18			
Errors Rabkin	<div> <div>1-10</div> <div>11-12</div> <div>13</div> </div>	<div>17</div> <div>6</div> <div>1</div>	<div>9</div> <div>37</div> <div>12</div>	<div>3</div> <div>10</div> <div>5</div>	<div>29</div> <div>53</div> <div>18</div>	59	40.9
		24	58	18			

		Score, Color-Threshold Test					
		64	63-35	34-18			
Grade, Anomaloscope	<div> <div>1</div> <div>2</div> <div>3</div> </div>	<div>3</div> <div>1</div> <div>0</div>	<div>2</div> <div>70</div> <div>6</div>	<div>0</div> <div>7</div> <div>11</div>	<div>5</div> <div>78</div> <div>17</div>	84	64.1
		4	78	18			

ened form of the Farnsworth 100-Hue Test, (3) an abridged version of the A.O. Pseudo-Isochromatic Charts, (4) the Rabkin Polychromatic Charts, (5) an anomaloscope (a modified Eastman color temperature meter).

In order to compare the six tests with one another, scores have been chosen for each which define three grades of defect. For three of the tests (the RCN Lantern, A.O., and Farnsworth) it is

The grades on the Color-Threshold, anomaloscope, and Rabkin tests show a somewhat similar degree of agreement when the score ranges for the Color-Threshold Test are chosen so that the distribution as to the number of individuals in each grade is approximately the same in the two tests compared. These results indicate that an individual with, for example, marked inability to distinguish colored lights of low intensity will prob-

TABLE 5

RELATIONSHIP BETWEEN SCORES ON COLOR-THRESHOLD TEST AND PERFORMANCE IN FIELD TESTS

Color-Threshold Score ..	Biscuit Gun—1 Mile, at dusk			
	Pass	Fail	Pass	Fail
44-64	24	5	50-64	20
43 or less	4	21	49 or less	8
				25

Pyrotechnic Signals, Red and Green				
		6 miles, 5000 ft., at night		
		Pass	Fail	
44-64	7	2	54-64	4
43 or less	1	5	53 or less	4
				7

## Note:

Scores of 55 or better made by 24 percent of color-deficient group  
 Scores of 50 or better made by 37 percent of color-deficient group  
 Scores of 45 or better made by 49 percent of color-deficient group

possible to define these so that about one third of the subjects fall in each grade. In comparing these three tests with the Color-Threshold Test, therefore, the scores on the latter have been chosen to give a similar distribution. Table 4 shows in the form of contingency tables the relationship between the grades on the four tests. It is obvious to inspection that there is some relation between the different tests. If there were no relationship whatsoever, about one third of the group would by chance show the same grade, whereas, for example, 58 of the 100 subjects have the same grade on the Color-Threshold Tester and the Canadian Lantern.

ably also show poor ability in other tasks requiring color discrimination. Since, however, the agreement with the scores on other tests is not perfect, the quantitative color-vision test chosen for the selection of air-crew personnel should be the one which correlates most closely with practical field tests related to the tasks required of such personnel.

Table 5 shows for color-deficient subjects the relationship between scores on the Color-Threshold Test and the results of practical field tests. One of the field tests consisted in having the subjects identify the red, green, and white signals from a traffic-control light, commonly called a "biscuit gun." The biscuit gun is a hand-

held signal light, whose essential parts are a lamp, paraboloidal reflector, red and green filters, and a sighting device for directing the beam. With a few exceptions, the 54 subjects took part in two independent tests involving identification of biscuit-gun signals, and were classified as failing if they made any errors in either test. The conditions under which the tests were conducted were such that none of the control group of subjects with normal color vision made any errors.

The data given in table 5 show that there is a fairly close relationship between Color-Threshold scores and ability to identify the "biscuit-gun" signals. If a qualifying score on the Color-Threshold Test of 44 or greater is taken, the results are in agreement with those of the practical field test in 45 of the 54 cases. If the qualifying score is raised to 50, the number who pass the Color-Threshold Test but fail to identify biscuit-gun signals is reduced from five to one.

In a second series of experiments, the subjects were required to identify red, green, and yellow pyrotechnic signals. In these tests the control group of normal subjects made no errors, but only 9 of the 80 color-deficient subjects failed to make

errors. These 9 individuals had scores of 57 or greater on the Color-Threshold Test. Because of their small number, it is probably not worth while to attempt to select the color-deficient individuals who are able to distinguish the three pyrotechnic signals. Similar tests in which only red and green flares were used were given to a small group of color-deficient subjects. The results, shown in table 5, suggest that an appreciable number can identify red and green flares if only these two colors are used. As was the case in the tests with the biscuit gun, the scores on the Color-Threshold Test show a fairly close relation to the results of the field tests.

The decision as to whether some color-deficient subjects can safely be qualified for pilots, bombardiers, navigators, or service pilots, and so on, must depend on further study of the color discriminations required of each group. Since the scores on the Color-Threshold Test show a fairly close relationship with actual performance, this test should prove to be of value in selecting those with adequate color vision for certain tasks.

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## DISCUSSION

DR. F. C. CORDES (San Francisco): The CAA stresses the importance of distinguishing low intensities of green and brown in depth perception. As an example, in distinguishing a meadow from a plowed field. Does the threshold lantern give us any information on this particular type?

DR. SLOAN: I am glad someone asked that question. There has been a good deal of discussion. It was thought at one time that identifying the nature of the terrain was one of the difficulties that the color blind might encounter. In fact, one of the

standard examples was that the men would not be able to tell the swampy ground, which is a bluish-green color, from a nice, smooth grass field, which is yellow-green. What they forget is that this is a blue-yellow discrimination and not a red-green discrimination at all.

The case mentioned would presumably be a red-green discrimination. But for two reasons I do not think red-green color discrimination is an important factor in identification of terrain: All of the color-deficient subjects who took part in these experiments were civilian pilot instructors.

limited to day flying. Some of them had quite marked defects, but they never had any difficulty in picking a field for a forced landing. They all laughed when we asked whether color had anything to do with it. They said, "You select a field by the smoothness or whether there are ditches or where the wind is coming from and by the texture rather than by color."

I think the same is true of camouflage. In all the books on camouflage, color is stressed very little. It is the inequalities in surface brightness by which you judge the type of landing field. I would not say that some particular situation might not occur in which confusion of a reddish field with a green field might not be made by a color-blind person. I thought at one time that a plowed field would make a poor landing field, but they tell me that it makes a good landing field if you land in the right direction in relation to the furrows.

We had a pilot fly while wearing red goggles, which eliminated all hue differences. When these are worn for a while everything appears as a washed-out pink. He said that he had no difficulty whatever while wearing them in knowing what the different fields were and he did not believe that color is an important clue. The goggles may have distorted the brightnesses a little, but at least they did not handicap him. We should make such tests on more pilots. In this one case the pilot was perfectly willing to wear red goggles while selecting a landing field.

DR. T. J. DIMITRY (New Orleans): Do women pass these simple tests better than men?

DR. SLOAN: Since I have been at the School of Aviation Medicine I have not tested many women. At the Wilmer Institute I saw one or two color-blind women, but they are extremely rare. I imagine that all the WASPS are given the same tests and I haven't heard of any problem

of color blindness there. In standardizing this test, we have given it to the various secretaries around the School, and they make normal scores on it. We have come across one color-blind woman. She is the mother of one of the enlisted men who is color blind. In reading the pseudo-isochromatic charts she makes a few errors. I believe that the women carriers, if tested carefully enough, might show very slight defects.

DR. H. S. GRADLE: How does the test lantern differ from the Williams Test Lantern, and what is the time of exposure of the color field?

DR. SLOAN: I am not very familiar with the Williams Lantern. All of the so-called lantern tests have a great deal in common. Many do not use standardized colors which can be reproduced. The test field in the Williams Lantern is much larger than that in the Color-Threshold Tester, which makes the test easier. One important feature of the test I have described is that colors are shown at very low intensities such that even the normal individual can barely distinguish them.

The other question was about the time of exposure. It has been asked before whether we should control time of exposure. We tried having a shutter, and it just complicated the instrument. We allow about five seconds and then proceed to the next color if we do not get an answer. Even if you had a shutter, you would still have to have some means of regulating the time of exposure. Personally, I do not believe that time of exposure makes too much difference. The normals give the right answer promptly and the color deficient want to take longer. We have tried giving them as long as they want and they still do not give the correct answer.

DR. HARRY S. GRADLE: I remember that six or eight months ago there was a great furor about training color-deficient

men who had been rejected. Have you had any of these men?—

DR. SLOAN: Yes, we have had quite a few.

DR. GRADLE: Will you make a statement for us?

DR. SLOAN: One of the treatments for color blindness consists in exposing the eyes to a bright red light. Immediately after this, the subject attempts to read the charts. He is able to see some of them because the preexposure to red has somewhat the same effect as viewing the charts through a green filter. Similarly, preexposure to green light, which is used next, has somewhat the same effect as viewing the charts through a red filter. When this process is repeated day after day the subject gradually memorizes a number of the charts. We have tested about 10 men who have taken such treatments and they fail on all tests of color vision in which this training is not a factor. The Rabkin Polychromatic Charts, for example, are produced in Russia and are not among those used in training color vision, because they are difficult to obtain. We also use a test similar to Nagel's anomaloscope. This is also failed by the subjects who have taken the so-called "cures" for color blindness. The pseudo-isochromatic-chart type of test is not meant for use in repeat tests. These charts work very well if the subjects have not had a chance to study them.

We thought that vitamin A as a cure for color blindness was worthy of a trial. A number of color-deficient individuals took large amounts for three months. They were given a number of different tests before and after but not during the treatment. None showed the slightest evi-

dence of any improvement.

DR. GRADLE: Still I should like you to come out positively: Did this so-called treatment for color blindness have any influence on the color perception of the individual?

DR. SLOAN: Absolutely none.

DR. ALBERT C. SNELL: Do you consider the Ishihara test an adequate screening test for the inductees?

DR. SLOAN: The Ishihara tests that are available in the Army at the moment are so faded that they certainly ought to be condemned. It is not possible to get new ones, so that leaves only the American Optical Company test available. This is not so good a test as the Ishihara. What we have done is to select a series of 17 charts from the complete American Optical edition. We eliminated the charts which the normals read incorrectly, and those that the color blind practically always read correctly. In the end we had 17 charts that gave a very clean-cut separation. The normals may occasionally make as many as three errors. At least 90 percent of the color-deficient group make 15 to 17 errors; 17 being the maximum possible. There are a number in the color-deficient group who do not fail all of them, but, in general, the abridged version is far better than the complete American Optical Company test, in my opinion. Substitution of the abridged series of charts is something that can be done immediately. There is, however, need for better tests, because with pseudo-isochromatic charts there is always the possibility of coaching. I think that eventually they ought to design new pseudo-isochromatic charts that cannot be learned or use some other type of screening test.

# THE DISSOCIATION OF FORM VISION AND LIGHT PERCEPTION IN STRABISMIC AMBLYOPIA\*

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## INTRODUCTION

The amblyopia associated with strabismus is distinguished from other types of reduced visual acuity in two ways: (a) the amblyopic eye is ophthalmoscopically normal in every respect; and (b) its visual acuity can be improved in certain cases and to various degrees by prolonged occlusion of the dominant eye.

Until both these characteristics had been adequately established it was uncertain whether the strabismus was the cause or the consequence of the amblyopia. Up to very recently the view has been maintained that a congenital defect of the central retina in one eye, attended by low visual acuity, might cause the strabismus. The absence of anatomic signs, however, and the success with which the amblyopic condition can frequently be improved by use and training, have demonstrated the essentially functional nature of the defect in the great majority of cases. It now appears probable that ordinarily the amblyopia is an adaptation to strabismus which prevents diplopia by suppression of the response from one eye.<sup>†</sup>

The nature of this suppression is still obscure. Some functional deterioration

of the visual mechanism might be associated with disuse of one eye (hence amblyopia *ex anopsia*); or alternatively responses from the affected eye might be actively inhibited ("*Hemmungsamblyopie*"; cf. Harms, 1938). In the latter event this type of amblyopia may differ only in its relative permanence from those cases of alternating strabismus in which either eye alone is capable of a high visual acuity, while the visual acuity of the deviated eye is temporarily suppressed.

The site of the defect also is not known. The demonstration that strabismic amblyopia is curable has led many workers to assume it to be "psychic" in nature; we take this to mean that it involves the participation of the cerebral cortex. A cortical dysfunction or inhibition might confine its effects to the cortex itself, or might project them centrifugally upon lower levels of the visual pathways. Harms (1938), as the result of studies of the pupillary light reflex in normal and amblyopic eyes, has concluded that the inhibition, though originating in the cortex, is projected so as to suppress the activity of the retina itself.<sup>‡</sup>

\* From the Dartmouth Eye Institute, Dartmouth Medical School, and the Biological Laboratories of Harvard University. Presented at the fourteenth scientific meeting of the Association for Research in Ophthalmology, at Chicago, June 13, 1944. This research was supported in part by a grant to one of us (G. W.) by the Josiah Macy, Jr., Foundation.

† An excellent review of this subject and its literature can be found in the paper by Harms (1938).

‡ It might be supposed that because of the semidecussation of the optic tracts and consequent central projection of corresponding areas of the two retinas upon the same side of the cortex, any cortical effect upon visual sensation should involve binocular fields. Actually, however, these anatomic arrangements do not in themselves entail sensory "fusion." Sherrington (1906, p. 354ff.) has shown that on the contrary the unocular image retains a high degree of sensory integrity in binocular vision. The fact that strabismic amblyopia is unilateral, therefore, is not in conflict with its presumptive cortical origin. The same may be



In order to learn more about these matters, and at the suggestion of one of us (H. M. B.), we undertook an investigation of the absolute threshold of vision in amblyopic and normal eyes. All measurements reported here were performed at the Dartmouth Eye Institute in Hanover, New Hampshire.

#### APPARATUS

The adaptometer used for measuring visual thresholds in these experiments was designed and built by one of us (G. W.) at the Biological Laboratories of Harvard University. A description of its general design and operation follows; the details of its construction will be discussed elsewhere.

The distinguishing feature of this instrument is the use of a high-pressure mercury arc as source. From its radiation nine highly monochromatic regions of the spectrum are isolated with color filters. These include lines at about 365, 405, 436, 492, 546, 578 and 623  $m\mu$ ; and narrow continuous bands centered at about 690 and 760  $m\mu$ . The intensity which is delivered to the test field at each of these wave lengths is varied accurately by means of a calibrated optical wedge. The wedge alone provides a range of intensities of about six logarithmic units (about 1,000,000 times); the intensity can be still further reduced when necessary with neutral filters.

The test field is circular, and subtends a maximal visual angle of 2 degrees. Diaphragms may be placed over it to reduce its size to any desired degree. The field is exposed to the eye in flashes of constant duration, regulated with a camera shutter. In all the present experiments flashes of 0.04 second were employed.

said of the functional scotomata which frequently accompany strabismic amblyopia and are found also in the deviated eye in cases of alternating strabismus.

By means of a slide built into the viewing section of the instrument either eye can be occluded at will. In the present experiments the two eyes were measured alternately, the dominant eye serving as control for the amblyopic.

A fixation point is provided which may be moved to any position within a radius of 12 degrees from the center of the test field. This was constructed from a general design invented by Abney and Watson (1916). Light is led down a very narrow glass rod to appear as a bright point at its tip. The rod is mounted in a universal ball-joint so that it can be moved freely into any desired position. By this means it is possible to fixate the eye so that the image of the test field falls on the fovea or on any region of retina within 12 degrees of it. The fixation point is illuminated continuously, and its brightness is regulated with a rheostat.

With this instrument one can measure conveniently: (a) the dark adaptation—the decrease of threshold in darkness following a preliminary exposure to light—of any desired area of retina at any available wave length; (b) the variation of threshold with location of the field on the retina, at any of the available wave lengths; and (c) the energy threshold of the retina at various wave lengths of the spectrum, in central and peripheral areas. All three types of measurement were included in the present experiments.

#### OBSERVATIONS

All the experiments reported in this paper were performed upon five patients. Their clinical histories are appended below. Two of them were male college students, 18 and 23 years of age. The others were children—two 10-year-old boys and one 11-year-old girl. One of the students (G. E. T.) could be seen repeatedly and was the subject of the most extensive series of measurements. The others were

available only during routine visits to the clinic, none of them more often than twice. All these patients presented typical histories of strabismic amblyopia. In all of them the corrected vision of the dominant eye was at least 20/25, whereas that of the amblyopic eye was 20/200 or less.

It should be noted that all these patients were wholly unused to procedures such as the present one. For all of them it contained novel experiences and demands: long periods spent in total darkness, the requirement that they fixate accurately a point of light, and that they simultaneously recognize a flash of light at the absolute threshold of vision, often at a considerable distance from the fixation point, and often with the added demand that they specify its color. In view of their inexperience and of the youth of three of the patients the results obtained were gratifyingly accurate and clear.

In all our experiments the threshold was measured in the two eyes alternately, the behavior of the dominant eye serving as control for that of the amblyopic eye. In every case the data obtained with the better eye agreed with those from ordinary normal observers. The most relevant datum however, under all circumstances, is the relative performance of the two eyes rather than their absolute capacities.

It should be understood that absolute thresholds measured under carefully controlled conditions in normal observers may vary more than a logarithmic unit (that is, more than by a factor of 10) from person to person, and may vary 0.3 to 0.4 logarithmic unit in the same individual from day to day. In inexperienced observers the variation encountered in the course of a single measurement is usually 0.15 to 0.25 logarithmic unit, and may be larger. Differences of less than 0.3 logarithmic unit in our measurements therefore are probably not significant unless consistently maintained, and sporadic dif-

ferences even as high as 0.4 logarithmic unit need not be significant.

*Dark adaptation.* This was measured in a peripheral field in two patients. The subject was first highly light-adapted by exposure to a bright white light for 5 minutes. At the close of this period the light was turned off, leaving the patient in complete darkness. At periodic intervals thereafter the threshold was determined alternately in the dominant and the amblyopic eye. The minimal exposures to light which this procedure involves do not disturb the course of dark adaptation.

The results of one such experiment, performed on the student G. E. T., are shown in figure 1. The test field subtended a visual angle of 2 degrees, and was located so that its center lay 8 degrees below the fixation point; that is, so that its image fell on the retina 8 degrees above the fovea. Thresholds were measured with yellow light (578 m $\mu$ ).

At the beginning of dark adaptation the threshold falls sharply, reaching a first plateau which is maintained until about the thirteenth minute. Then the threshold falls again to a second and final plateau, attained in about 35 minutes. The decline in threshold to the first plateau is known to be due to the adaptation of cones; the second segment of adaptation is due to rods.

It is clear from figure 1 that the thresholds in the light-adapted condition and throughout the entire course of dark adaptation are essentially identical in the dominant and amblyopic eyes. Data from a similar experiment with the boy, R. H. S., although not so precise as those shown in figure 1, revealed the same correspondence in the thresholds of normal and amblyopic eyes.

*Threshold contours.* These were measured in the completely dark-adapted eyes

of three patients. The field, which subtended a visual angle of 1 degree, was centered within the fovea and at various distances above and below it, and the threshold was determined in each position. In this way one obtained a contour of the distribution of thresholds over the retinal surface.

In the student, G. E. T., this was done at two wave lengths, in the red (690  $m\mu$ ) and violet (436  $m\mu$ ); in the student, T. P.,

diation. The latter color was seen only within the fovea itself; that it was seen at all in light of such low wave length and in the dark-adapted eye—both conditions which favor the stimulation of rods—is an assurance of a remarkable capacity for accurate central fixation with the amblyopic eye. Even the deep red radiation (690  $m\mu$ ), which favors the stimulation of cones, was seen by G. E. T. as colored only within a radius of 1 degree of the fovea.

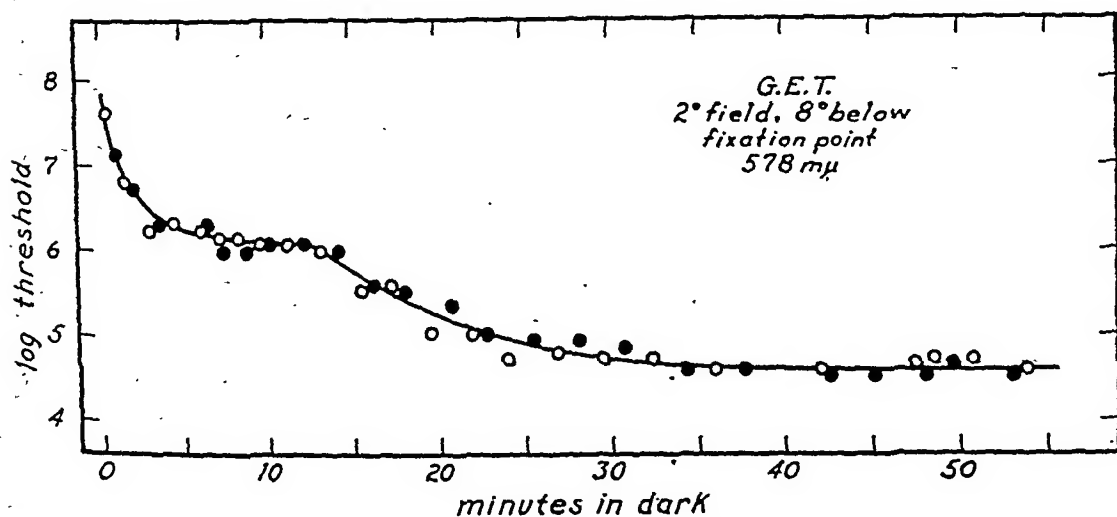


Fig. 1 (Wald and Burian). Dark adaptation following a 3-minute exposure to bright white light. The initial fall of threshold to a first plateau is due to cones, the second fall to a final minimal level is due to rods. Data from the amblyopic eye are shown with solid circles, those of the dominant eye with open circles. Thresholds are in arbitrary units of relative energy.

the contour was measured only above the fovea and in violet light. The data obtained in these experiments are shown in figure 2. In addition, a complete contour was measured in green light (546  $m\mu$ ) in the boy, G. E. C.

When located peripherally the field looks colorless, since here the threshold is due to rods, which excite only achromatic sensations. A field 1 degree in diameter, if fixated centrally with sufficient accuracy, falls entirely within the rod-free foveal area, and hence should be seen as colored. The appearance of color in this experiment is indicated in figure 2, with small letters, *r* for red, and *b* for blue, the reported color of the 436  $m\mu$  ra-

Characteristically such threshold contours have the bell-shaped form shown in figure 2, the threshold of the dark-adapted retina rising from the periphery toward the fovea. The central rise in threshold is particularly marked in violet light, for two reasons: the yellow pigmentation of the macular area selectively absorbs violet light; and the shift from rod to cone vision as the field moves into the fovea involves a decreased sensitivity to the violet (the Purkinje shift; cf. figure 3).

In figure 2 any tendency toward systematic deviations in threshold in the two eyes is indicated by separate curves. In red light G. E. T. displayed no such dif-

ferences peripherally or foveally. In violet light this observer's threshold in the amblyopic eye fell slightly *below* that of the dominant eye in the central region from 2 degrees above to 2 degrees below the fovea. In violet light T. P. did not show this difference centrally, but in the region 3 to 6 degrees above the fovea his

follows: The thresholds of the amblyopic eye, foveal and peripheral, are very close to those of the dominant eye in all cases. The small differences which have been observed are not maintained consistently from subject to subject; and to the degree that they are significant they reveal a greater sensitivity in the amblyopic eye.

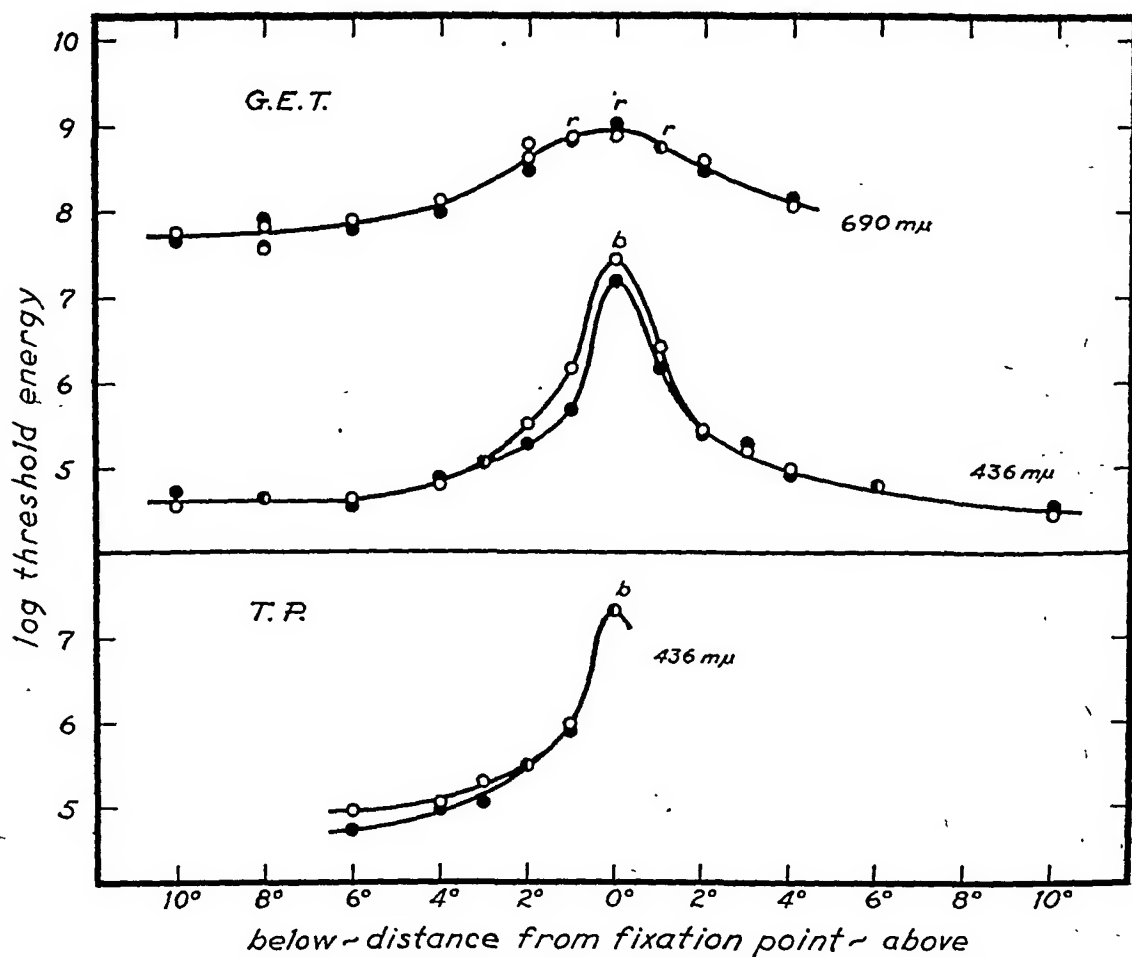


Fig. 2 (Wald and Burian). The variation of threshold with position of a 1-degree field on the retina, measured in red (690  $m\mu$ ) and violet light (436  $m\mu$ ) in the completely dark-adapted eye. The field appears colorless in the periphery, but colored centrally either red (r) or "blue" (b). Solid circles show data from the amblyopic, open circles those from the dominant eye.

amblyopic eye yielded thresholds slightly *lower* than the dominant eye. The data obtained with green light from G. E. C., not shown in the figure, displayed no consistent differences in threshold centrally or peripherally.

These results may be summarized as

*Spectral sensitivity.* The amounts of energy needed to stimulate minimal sensations of light or color vary greatly with the wave length. In a special series of experiments the thresholds of completely dark-adapted subjects were measured at a series of wave lengths, in fields of

fixed size and retinal location.

When such experiments are performed in peripheral areas of the retina, the image of the test field appears colorless regardless of the wave length. This is due to the fact that the threshold of the dark-adapted periphery is due to rods alone—

the intensity may be raised further until the color threshold is reached. The difference between the "white" and color thresholds is the familiar "photochromatic interval." A central field is most likely to appear initially as colorless when low wave lengths are employed, since to

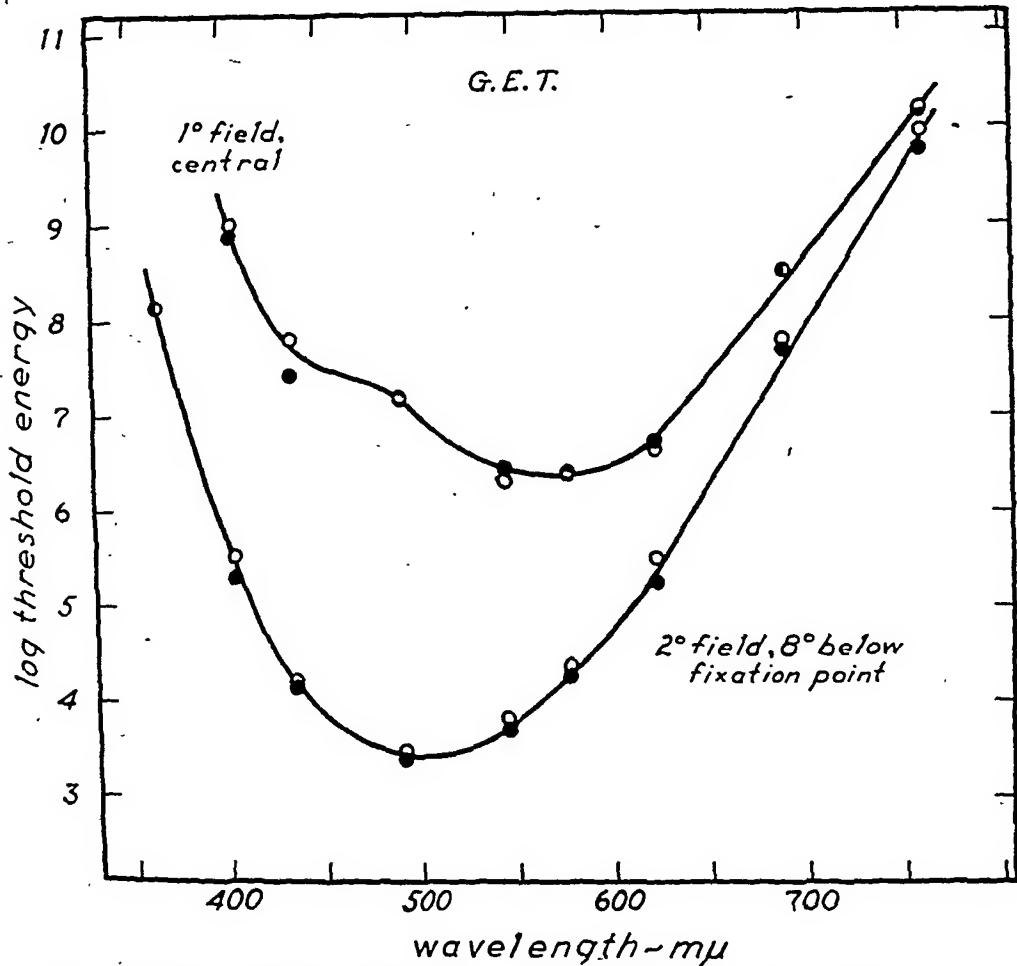


Fig. 3 (Wald and Burian). The variation of threshold with wave length in foveal and peripheral fields in a completely dark-adapted subject. All thresholds in the peripheral field were reported as colorless, all the foveal thresholds as colored. Solid circles show data from the amblyopic eye, open circles those from the dominant eye. Thresholds are in arbitrary units of relative energy.

even in red light, contrary to a persistent misapprehension. Fields fixated centrally may appear at the threshold as colored, an indication that cones are stimulated; or they may appear initially as colorless, showing that the stimulated area includes rods. In the latter event, after the "white" threshold has been recorded,

these the rods are peculiarly sensitive.

The variation of threshold with wave length in central and peripheral fields, measured in the student G. E. T., is shown in figure 3. In a 2-degree field centered 8 degrees below the fixation point the data are typical of those obtained from rods. The threshold is minimal at

about 505 m $\mu$ , rising steeply and more or less symmetrically toward both shorter and longer wave lengths. Throughout the spectrum the thresholds of both amblyopic and normal eyes of this observer remain close together, with the threshold of the amblyopic eye consistently slightly lower except at 365 m $\mu$ , where the thresholds of both eyes are equal.

With a field 1 degree in diameter fixated centrally this observer yielded the data shown in the upper curve of figure 3. Such a field, if the fixation is sufficiently accurate, ordinarily should fall entirely within the rod-free area of the fovea, about 1.7 degrees in diameter, and thus should stimulate only cones. Actually the curve shown is a typical cone function. The threshold is minimal at about 565 m $\mu$ , the value normal for foveal cones (Fedorov, et al., 1940). The displacement of the minimum threshold toward the red as compared with the rod function is typical of the shift of sensitivity associated with the transfer from rod to cone vision (the Purkinje shift). Furthermore this observer reported correctly at the absolute threshold the colors of the field at all wave lengths. There can be little doubt that throughout this experiment the subject maintained a sufficiently accurate fixation to hold the field wholly within the rod-free area.

In this purely foveal field the thresholds of dominant and amblyopic eyes were essentially identical. What differences appeared were small and were not consistently maintained from one wave length to another. The moderate difference recorded at 436 m $\mu$  may have been significant, however, since it appeared also in the central measurements at 436 m $\mu$  from this observer, shown in figure 2.

What is perhaps most surprising in these data is their unequivocal evidence that the patient could fixate centrally with his amblyopic eye with great pre-

cision. To hold a 1-degree field entirely within the fovea in the dark-adapted eye is a feat in any untrained observer; that this could be done with an amblyopic eye was wholly unexpected.

The spectral sensitivity in a 1-degree field fixated centrally was measured also in T. P. The data are shown in figure 4. In this instance the result obtained in the amblyopic eye differs in a consistent way from that in the dominant eye. In the latter case the curve is typically cone in form and position, the threshold minimal at about 565 m $\mu$ . In the amblyopic eye the curve is of about the same shape, but is displaced toward shorter wave lengths, so that the minimum threshold lies at about 545 m $\mu$ . The net effect of this displacement is that below about 565 m $\mu$  the thresholds in the amblyopic eye are lower, above 565 m $\mu$  they are higher than those of the normal eye.

This shift of sensitivity is as though the stimulated area in the amblyopic eye included a number of rods, as it might have done were fixation not sufficiently precise to hold the field within the rod-free area. A number of attendant circumstances support this interpretation of the data. This subject in general reported color sensations only rarely; it is significant that in the present instance he reported seeing the threshold stimulus at 436 m $\mu$  as "blue" with the dominant eye, as colorless with the amblyopic. The same observer, in the experiment shown in figure 2, saw a 1-degree central field as blue at about the same intensity with both eyes; actually in this case also, however, he had reported seeing the field as colorless in the amblyopic eye about 0.5 logarithmic unit lower than the color threshold. At the time the measurements shown in figure 4 were performed, this subject complained of difficulty in fixating with the amblyopic eye, saying that he felt that this eye tended to wander off

the fixation point. It is important to note, however, that the central data from the amblyopic eye are still overwhelmingly of the cone type, as comparison with the peripheral (rod) data of figure 3 shows. We should conclude, therefore, that even this patient displayed a remarkable ca-

lengths, and the intensity must be raised further to reach the color threshold. Both "white" and color thresholds are shown in the table.

In G. E. T. the thresholds of the amblyopic eye at low wave lengths tend to lie slightly below, those at long wave

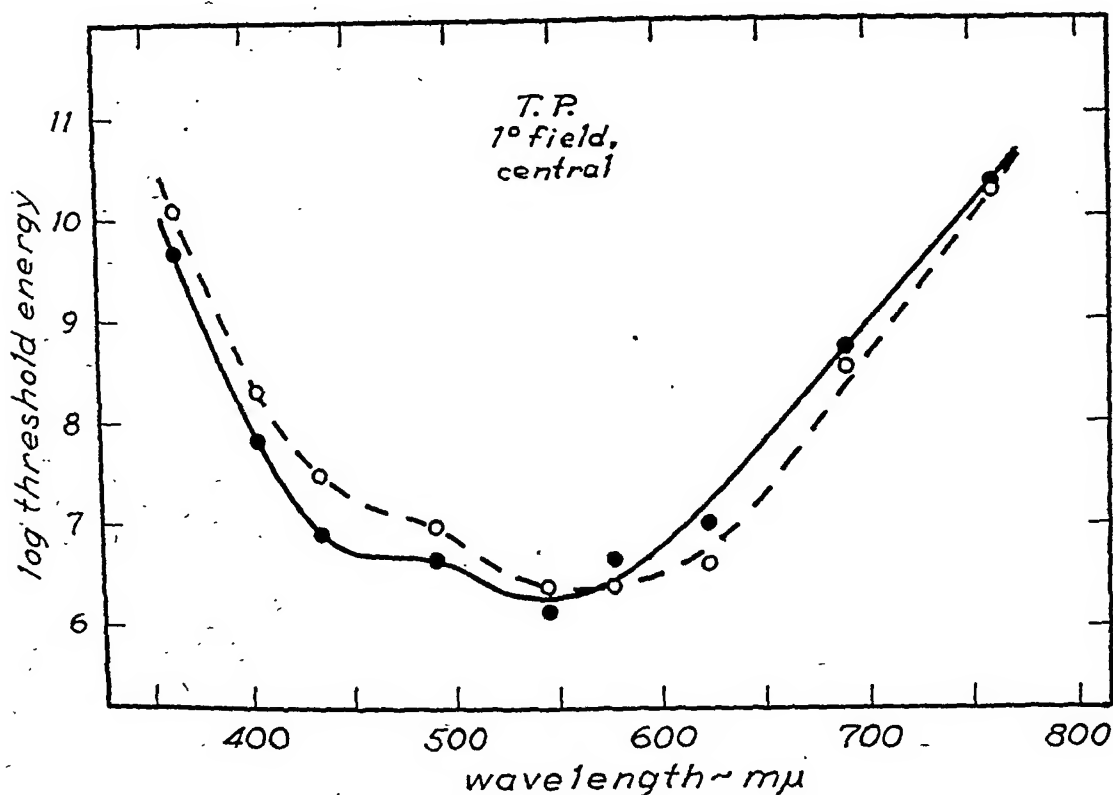


Fig. 4 (Wald and Burian). The variation of threshold with wave length in a 1-degree field fixated centrally, in the subject T. P. The solid line and solid circles show data from the amblyopic eye; the broken line and open circles show measurements from the dominant eye.

capacity for central fixation with the amblyopic eye, though not as precise as that of his normal eye, or as either eye of G. E. T.

In three patients the spectral sensitivity was measured in a field 2 degrees in diameter, fixated centrally. The data are shown in table 1. Such a field could possibly be contained wholly within the fovea in certain instances, but ordinarily it projects beyond this at its boundaries and includes a few rods. For this reason the field is usually seen at the threshold as colorless, particularly at shorter wave

lengths slightly above those in the dominant eye. These differences are comparable in trend with those shown in figure 4. In R. S. no significant differences appear between the two eyes throughout the spectrum. In I. M. the thresholds in the amblyopic eye lie consistently about 0.4 logarithmic unit below those in the dominant eye. The averaged results for these subjects reveal a tendency of the thresholds in the amblyopic eye to fall below those of the dominant eye, marked at short wave lengths, probably insignificant at long



wave lengths. The differences are relatively small in all cases. They probably mean—in the subjects G. E. T. and I. M.—a greater participation of rods in the thresholds of the amblyopic eye, due to less perfect central fixation. In R. S.,

It is clear also from these measurements that both cone and rod apparatuses are intact in the amblyopic eye; and that the sensitivity of its fovea is not consistently inferior to that of the dominant fovea of the same subject.

TABLE 1

THRESHOLDS OF AMBLYOPIC AND DOMINANT EYES OF THREE SUBJECTS, MEASURED AT VARIOUS WAVE LENGTHS IN A FIELD 2 DEGREES IN DIAMETER, FIXATED CENTRALLY. AT LOW WAVE LENGTHS SUBJECTS USUALLY REPORT THE FIELD INITIALLY AS COLORLESS ("WHITE"); THE INTENSITY MUST BE RAISED FURTHER TO REACH THE COLOR THRESHOLD. THRESHOLDS ARE EXPRESSED AS LOGARITHM OF THE RELATIVE ENERGY.

Wave length (mμ)	Type of Thresh-old	Log Threshold Energy							
		G. E. T. Age 18		R. S. Age 10		I. M. Age 11		Averages	
		Ambly.	Dom.	Ambly.	Dom.	Ambly.	Dom.	Ambly.	Dom.
365	white	10.30	10.21	—	—	10.02	10.40	10.16	10.30
	color	10.91	11.10	10.27	10.34	10.21	10.57	10.45	10.67
405	white	7.67	8.00	7.59	7.52	7.11	7.51	7.46	7.68
	color	7.86	8.12	7.75	7.60	7.27	7.68	7.63	7.80
436	white	—	—	—	—	5.97	6.33	—	—
	color	6.63	7.05	6.63	6.63	6.17	6.53	6.48	6.77
546	white	5.60	5.65	—	—	5.48	5.88	5.54	5.77
	color	6.00	6.01	5.72	5.55	—	—	5.86	5.78
578	white	—	—	—	—	5.98	6.19	—	—
	color	5.85	5.69	6.17	6.13	6.06	6.34	6.03	6.05
623	color	6.01	5.93	6.25	6.17	6.09	6.66	6.12	6.25

in whom these differences did not appear, a marked fixation nystagmus was observed in both eyes; it might be concluded that for this reason central fixation in both eyes was equally imperfect. It is curious, however, that this patient reported the color correctly at the absolute threshold in both eyes at all wave lengths but 405 mμ, at which he saw the field as colorless slightly below the color threshold (cf. table 1).

A small superiority in fixation by the dominant eye being in general conceded, it must be stressed that this is not always evident, and that in any case fixation by the amblyopic eye in view of its low visual acuity is amazingly good.\*

\* It is significant that when the fixation star was presented alternately to the two eyes, none of the patients observed any appreciable difference in its appearance.

CLINICAL REPORTS

R. H. S., white boy, 10 years old. The left eye had turned in ever since the first year of life. When first seen at the age of three years, the patient had a convergent strabismus of the left eye of 70°. The visual acuity of the left eye had always been extremely low and was not materially improved by occlusion. The angle of squint had been reduced by operative procedures to 4 to 5°. Visual acuity, with correction: R.E. (+2.50D. sph. ⊕ +1.50D. cyl. ax. 80°) = 20/25-2; L.E. (+2.00D. sph. ⊕ +0.75D. cyl. ax. 100°) = 10/200, eccentric fixation.

T. P., white male, 23 years old. The right eye used to turn in when the patient was a child; it straightened spontaneously. Visual acuity: without correction, R.E. 20/400; L.E. 20/400; with correction, R.E. (-0.50D. sph. ⊕ -0.25D. cyl. ax. 30°) = 20/400+1; L.E. (-1.75D. sph.) = 20/12. There is a convergent strabismus of 10° with normal retinal correspondence in the afterimage test and on the synoptophore. The patient has fusional amplitudes, but cannot bar-read.

G. E. C., Jr., white boy, 10 years old. Turning in of the left eye was noticed by parents one-year prior to examination. Visual acuity: without correction, R.E. 20/20; L.E. 20/200; with correction, R.E. (+1.25D. sph.  $\approx$  +0.50D. cyl. ax. 90°) = 20/20; L.E. (+0.50D. sph.  $\approx$  +1.00D. cyl. ax. 90°) = 20/200+1, fixation uncertain. There is a convergent strabismus of the left eye of 15°. The amblyopia prevents exact determination of the sensorial retinal relationship.

G. E. T., Jr., white male, 18 years old. Turning in of the right eye had been noticed since the patient's second year of life. He has worn glasses since the age of five years. At the age of 10 years he had orthoptic treatment for 18 months. Visual acuity: without correction, R.E. 20/200; L.E. 20/20+2; with correction, R.E. (+3.00D. sph.  $\approx$  +0.75D. cyl. ax. 100°) = 20/200+1; L.E. (+3.00D. sph.  $\approx$  +0.25D. cyl. ax. 135°) = 20/15. There is, with correction, a convergent strabismus of the right eye of 15 degrees with anomalous correspondence in the afterimage test.

I. M., white girl, 11 years old. No cross-eyedness noticed by parents. Poor vision in right eye discovered by school nurse. Visual acuity: without correction, R.E. 20/400; L.E. 20/20; with correction, R.E. (+7.50D. sph.) = 20/200, fixation uncertain; L.E. (+5.00D. sph.  $\approx$  +0.75D. cyl. ax. 135°) = 20/20. There is a convergent strabismus of the right eye of 12°, with 2° of right hypertropia. Retinal correspondence normal on the synoptophore; the patient has fusional amplitudes. After total occlusion of the left eye for one month following the tests, the corrected visual acuity improved only to 20/200+1, but the fixation was much better and steadier and the patient reported considerable subjective improvement.

## DISCUSSION

The results of our experiments may be summarized as follows: In the instances of strabismic amblyopia that we have examined the absolute threshold was normal, foveally and peripherally, in cones and rods, and in light and dark adaptation. It must be concluded that the entire apparatus of simple light perception is normal in these subjects. With this was associated a capacity approaching normal for fixating and localizing illuminated points and areas on the central and peripheral retina.

More extensive examination of this class of patients may reveal that some of them react differently from what is here described. This should not detract materially from the conclusions which we wish to draw. Yet it should be noted that all our subjects presented exemplary cases of the defect under consideration, and responded uniformly to our procedures. For these reasons it may be hoped that the results of our experiments and our conclusions from them are generally valid.

That the capacity for pattern discrimination may fall as low as 20/200 to 20/400 without any loss of sensitivity to light shows that in man the apparatus for form vision is to some degree distinct from that involved in simple light perception. This inference is consistent with the results of recent investigations of central structures concerned in vision.

It has recently been shown that in rats (Lashley, 1931), dogs (Pavlov, 1927, p. 341; Marquis, 1934), cats (Smith, 1937), and monkeys (Klüver, 1941, 1942; Marquis and Hilgard, 1937), complete removal of the occipital lobes of the cerebral cortex results in virtually complete loss of pattern and object vision, with little if any observable loss in the capacity to react to light or discriminate brightnesses.\* Such animals also may retain a capacity to localize stimuli within the visual field sufficiently good to be of important use in orienting the animal's movements. These experiments show that in mammals generally the anatomic structures associated with simple light discrimination and some degree of visual spatial orientation are subcortical, whereas pattern and object vision require the services of the occipital cortex. The animal deprived of its visual cortex ex-

\* Excellent reviews of this subject have been written by Marquis (1934) and more recently by Fulton (1943) with Marquis's collaboration.

hibits in extreme form properties which resemble to a remarkable degree those found in the amblyopic vision of our patients.

It has been reported that in man complete destruction of the occipital lobes results in complete and permanent blindness, and the loss of all sensations to light (Marquis, 1934). Apparently in man all sensory aspects of vision possess indispensable cortical components. Perhaps this may be viewed as a final stage in the phylogenetic "encephalization" of visual functions (cf. Marquis, 1935). Our experiments show, however, that in man also, since pattern vision can be so completely separated functionally from light perception and spatial projection, these functions must maintain some degree of anatomic separation.\* One may suppose further that within this sensory hierarchy, pattern vision, as in lower mammals, continues to occupy the higher level.

These considerations lead to the following conception of the nature of strabismic amblyopia. It appears to consist in a cortical inhibition of the higher cortical function of pattern vision, without notable impairment of the lower cortical functions of simple light perception and spatial localization. If, as we and others have supposed, the object of the amblyopia is to prevent diplopia in strabismus, this is accomplished with the maximum economy. Only the disturbing image is suppressed, without interfering with irrelevant visual functions or structures.

The localization of the primary defect in strabismic amblyopia in the cerebral cortex places it in that organ of the nervous system primarily concerned with the formation of new adaptive responses.

We have in this consideration some physiological sanction for the cure of such amblyopias through use and training, and support for the belief that the defect itself arises as an adaptation to strabismus, imposed upon an originally normal visual apparatus.

This conception of strabismic amblyopia differs in important ways from that proposed recently by Harms (1938). This investigator had measured the pupillo-motor sensitivity of the retinal center and periphery in normal and amblyopic eyes. In the normal retina the center is more effective than the periphery in closing the pupil. In amblyopic eyes Harms found the central sensitivity to be relatively decreased. He concluded that the defect in strabismic amblyopia must be located below the point at which the pupillary pathways depart from the visual projection, a consideration which he believed restricted it to the optic tract, optic nerve, and retina. He decided that it must, in fact, lie in the retina. Though agreeing that the inhibitory process originates in the cerebral cortex, Harms concluded that it is projected centrifugally so as to suppress the activity of the retina itself.

Apart from the fact that no mechanism for cortical inhibition of retinal function has yet been demonstrated, it is difficult to imagine what form it could take that is not excluded by the present experiments. We have shown that retinal sensitivity is not directly decreased in strabismic amblyopia. An alternative possibility—that the activity of some elements is entirely suppressed while others continue to function normally—would explain the low visual acuity that is observed; but this also cannot be the case, since it is well known that any diminution in the number of elements stimulated—as by decrease in the size of a test field—raises the threshold to light (cf. Wald,

\* Riddoch (1917) has discussed the dissociation of perceptions of light, form, and movement in the visual field, in cases of human occipital injury.

1937-1938). For these reasons the conclusion of Harms that in strabismic amblyopia retinal function is inhibited must be rejected.

Harms's observations are open to a simpler interpretation. Cortical centers are now known to exist for both dilation and constriction of the pupil (Parsons, 1901; Wang et al., 1931). It is therefore not necessary to assume an intermediate inhibition of retinal function to explain Harms's results. It may be supposed, instead, that the cortical inhibition in strabismic amblyopia is not confined to visual acuity, but extends further to include cortical pupillo-motor centers. Harms's observations indicate, however, that the pupillo-motor inhibition principally involves the projection of the *macular* region of the retina upon the cortex.

There is reason to suspect that the macular projection may be principally involved also in the inhibition of visual acuity. The residual visual acuity of the amblyopic eye is comparable with that found normally in the retinal periphery. Visual acuities of 20/200 to 20/400, such as our patients exhibited, are observed in normal eyes in areas 20 to 40 degrees from the fixation point (Wertheim, 1894). It is certainly the macular apparatus that principally loses visual acuity in amblyopia. The relative effects of strabismic amblyopia upon central and peripheral visual acuity need to be carefully examined.

A selective inhibition of the macular projection would affect pattern vision principally in bright light, and might leave it almost unchanged in dim illuminations. Some such effect might explain the extraordinary capacities of the amblyopic eyes of our subjects in the dark room as compared with their behavior on clinical examination in ordinary light. In the latter case one patient (R. S.) was

unable to maintain central fixation with either eye; in all the other patients fixation with the amblyopic eye was observably unsteady. Yet amblyopic and dominant eyes behaved so similarly in our experimental procedures that had we not been aware of the histories of these patients, nothing in the course of the measurements would have suggested that their eyes differed in capacity. The possibility therefore that the amblyopia might be particularly associated with vision in bright light also requires critical examination.

It is curious that this possibility has arisen also in connection with animals from which the visual cortex had been removed bilaterally.\* Smith (1937) has reported that cats in this condition fail to learn an intensity discrimination habit in bright surroundings although able to learn the same habit easily when the surrounding illumination is reduced. Klüver (1942) found that monkeys lacking the occipital cortex respond to a single light or differentiate two lights only if the over-all illumination is low or the intensity of the stimuli is very high. Poppelreuter (1923) has reported furthermore, that following occipital injuries due to gunshot wounds in man, and in hemianopias associated with central nervous diseases, patients may be entirely blind in the affected regions in bright light, yet always exhibit "amorphous" reactions to light in the dark room.

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\* The extraordinary fidelity with which strabismic amblyopia mimics the condition found in animals deprived of the visual cortex may be judged from the remarks of Lashley (1931) concerning his observations on rats following this operation: "The defects of vision may be interpreted either in terms of an amblyopia with dim vision retained throughout with normal vision in the peripheral field. The visual field or an extensive central scotoma little evidence available seems to favor the former interpretation."

## SUMMARY

1. The absolute threshold of vision has been measured under various circumstances in five patients with strabismic amblyopia. In all cases thresholds were determined alternately in the amblyopic and dominant eyes. Three types of measurement were performed: (a) dark adaptation following a high state of light adaptation; (b) the distribution of thresholds over the retinal surface, central and peripheral, in the dark-adapted eye; and (c) the variation of threshold with wave length, centrally and peripherally, in the dark-adapted eye.

2. In all cases the threshold of the amblyopic eye was found to be essentially normal, foveally and peripherally, in cones and rods, and in light and dark adaptation. With this is associated a capacity approaching normal for fixating and localizing illuminated points and areas on the central and peripheral retina.

3. The entire apparatus of simple light perception and spatial localization within the visual field is therefore virtually normal in these patients. Since, however, the visual acuities of their amblyopic eyes were in no case higher than 20/200, the apparatus of pattern vision must be to some degree distinct from that which mediates the other visual functions.

4. Subhuman mammals which have

been deprived of the occipital lobes of the cerebral cortex, which contain the visual areas, also lose virtually all capacity for pattern vision while retaining sensitivity to light, brightness discrimination, and visual-space localization. Pattern vision in mammals generally, therefore, requires the cortex, while other visual functions appear to be in large measure subcortical. In man there is evidence that all sensory aspects of vision have indispensable cortical components. Our experiments, however, show that here also some degree of anatomic dissociation of visual functions must exist.

5. In view of these relationships, and of the demonstrated effectiveness of use and training in curing some cases of strabismic amblyopia, it is concluded that this disability consists in a cortical inhibition of the higher cortical function of pattern vision without notable impairment of the lower cortical functions of light perception and spatial projection.

6. The possibility exists that this inhibition involves principally the macular projection on the cortex and, perhaps as a consequence of this, pattern vision primarily in bright light.

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## DISCUSSION

DR. SLOAN: Would this explain improvement in light threshold *without* improvement in form vision in recovery from vitamin-A deficiency?

DR. BURIAN: No, I do not believe so.

DR. SLOAN: May I explain why I asked the question? We have had such cases. About six men were referred because they had difficulty in night flying. There were evidences that they had been on poor diets. They were returned to a normal vitamin-A diet, and the light threshold recovered before form perception in low illumination.

DR. BURIAN: The improvement in the light threshold by vitamin-A therapy is a peripheral process; we believe the dissociation of light perception and form vision in our amblyopia patients to be of central origin. May I add that our as-

sumption is strengthened by clinical experience gathered during the last war in England, France, and Germany. Patients who had sustained gunshot wounds to the occipital lobes, in recovering sight first regained light perception. Qualitative light perception was the first degree of restitution before any form vision was reacquired.

DR. CLAPP: Please comment on the efficiency of light-flashing orthoptic apparatus in amblyopia ex anopsia.

THE CHAIRMAN: It seems to me that that is a little outside the province of this paper.

DR. BURIAN: It is, and I have had no personal experience with it. It is, however, conceivable that better fixation may be obtained in amblyopic eyes when light is presented in short flashes.

# THE HISTORY AND DEVELOPMENT OF THE IRIS- INCLUSION OPERATIONS\*

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It was quite obvious to Sir William Adams in 1812 that some better method of treating painful eye disorders was necessary than the usual routine in vogue in his time. Ten years earlier, in 1802, according to J. V. Solomon,<sup>1</sup> writing in 1863, Dr. Whyte<sup>2</sup> had recommended a section of the ciliary region for the relief of pain. He is quoted as follows:

"In cases of enlargement of the anterior hemispheres of the eye . . . puncturing the eyeball with a couching needle. His incision was made through the sclerotica into the posterior aqueous chamber, the instrument being carried 'behind and parallel to the iris.' He directs 'the outlet' (incision) should be 'proportioned to the existent expansion' . . ."

Solomon goes on to say that in 1807 Mr. Wardrop in the *Edinburgh Medical and Surgical Journal* (volume III) wrote on the "Relief of inflammation of the eye by opening the cornea and evacuating the aqueous humour," and in 1813 presented a paper in London before the Medico-Chirurgical Society:<sup>3</sup> "On the effects of evacuating the aqueous humour in inflammation of the eyes and some diseases of the cornea," in which he refers to the great and immediate relief of his patients on the sudden removal of tension.

Naturally these operative measures were not always followed by happy results; surgeons became fearful of such brutal attacks on so delicate an organ. Adams studied enucleated eyes and finally wrote a "Treatise on artificial pupil,"<sup>4</sup> in which is described a series of improved operations that he and his disciples had

used from 1812 to 1819 and had called *iridencleisis*.

One of his pupils, Karl Himly,<sup>5</sup> in 1816 quoted Adams as noting that the prevalent method of treating eye diseases "by blood letting to the point of fainting and extreme weakness" often left the patient in a dire condition for years. He therefore sought to treat the eye itself by less drastic means whenever possible. Among other observations, he noted that certain patients could not see if their pupils were occluded by inflammatory exudate; and after the acute inflammatory signs had abated he would try to make new pupils for them by incising the cornea, allowing the aqueous to escape and then drawing a portion of the iris outside of the aqueous chamber and usually excising the prolapse. In such cases the cornea would often become less cloudy, there was return of the sight and there was relief from pain and headache as soon as the pain from the operation itself passed. He also would rub the inflamed eye through the upper or lower eyelid with his finger, in spite of the risk involved. These procedures he taught to others, among whom was Karl Himly, who continued to practice them and to write about them in Germany.

The middle of the 19th century saw men like Bowman working in England, Graefe in Germany, Donders in Holland. Each in his own way was working out his clinical problems; each had associates. One of Bowman's associates was George Critchett who became a great London ophthalmologist. At the age of 30 years he wrote a paper<sup>6</sup> on "Iridesis: or the formation of artificial pupil by tying the iris."

The operation is performed in the fol-

\* Presented at the Chicago Ophthalmological Society, November 15, 1943.



lowing manner: "A wire speculum is inserted, and with a pair of forceps a small fold of the conjunctiva close to the cornea is held so as to fix the eye. An opening is then made with a broad needle through the margin of the cornea, close to the sclerotic, and just of sufficient size to admit the cannula forceps: with it a small portion of the iris, near, but not close to, its ciliary attachment, is seized and drawn out to the extent considered necessary to enlarge the pupil; a piece of fine floss silk, previously tied in a small loop around the cannula forceps, is slipped down and carefully tightened around the portion of iris made to prolapse, so as to include and strangulate it. This manœuvre requires a little practice and dexterity and is best accomplished by holding each end of the silk with a pair of small forceps with broad extremities, bringing them exactly to the place where the knot is to be tied, and then drawing it moderately tight. A single tie is sufficient; the ends are then cut off and the operation is complete. Little or no irritation usually follows. The small portion of iris included in the ligature speedily shrinks, leaving the loop of silk, which may be removed from the eye about the second day. This operation has been performed many times by myself and my colleagues, Mr. Bowman and Mr. Poland, and the result has been in every respect most satisfactory."

In volume II is found an addendum: "Further remarks on the formation of artificial pupil by iridesis." In this article<sup>7</sup> the writer describes some changes he has made in his technique and also gives some cases illustrative of the various "morbid" conditions to which it is suited. "I believe that it (iridesis) possesses important advantages over every method hitherto proposed . . . and I confidently anticipate its very general adoption."

It is interesting to note some remarks

that this same George Critchett made on June 9, 1882, just five months before his death. At the time he was vice-president of the British Ophthalmological Society.<sup>8</sup> In discussing a paper on sclerectomy he made it very evident that he disapproved the inclusion of iris in a scleral wound, on account of the danger of sympathetic ophthalmia: "I am careful always to divide the corneosclerotic tissue just in front of the ciliary body and to leave a small bridle of this tissue undivided. If a slight prolapse of the iris occur at either corner, I endeavor to remove it." A recent remark on the Critchett operation was made by Samuel Theobald<sup>9</sup> of Baltimore, in discussing Harrower's contribution (vide below): "The operation was done where there was a central corneal opacity, the idea being to obtain a narrow pupil with apex at the margin of the cornea. An incision having been made in the corneo-scleral junction with a broad needle, the iris was seized at the pupillary margin with a blunt hook, drawn out, and about it was tied a fine silk loop. The included portion sloughed and the iris became adherent to the corneal wound. The immediate result was satisfactory but the operation was eventually abandoned because, every now and then, a case of sympathetic ophthalmitis resulted."

While this was going on in England, Von Graefe was writing his monographs on iridectomy in iritis, choroiditis, and glaucoma. In 1857 he introduced iridectomy<sup>10</sup> as the best operation for glaucoma, and specified three cardinal principles of technique: (1) Make the incision enter the extreme periphery of the chamber. (2) Make the incision as broad as possible. (3) Tear the iris from the root.

He believed the operation opened up the natural channels of outlet for the aqueous.

To appreciate the situation in Von Graefe's time we should recall that ophthalmology was just emerging from the dark ages. Although a method of examining the interior of the eye by reflected light had been expounded by Helmholtz in 1851, glaucoma was not the entity nor symptom complex that we know today. The importance of hardness of the eye was just being appreciated, and the degree of hardness was measured by the fingers as +1, +2, +3, and stony hard. When hardness was associated with hyperemia and pain, it was an acutely "inflammatory" eye for which the patient would insist on some relief even if it meant removal of the eye. The only medical measures at hand were the opiates. Opening the cornea to let out the aqueous would give only temporary relief without much chance of saving the sight. So it was a great boon to humanity when Graefe found that by using a limbal incision and by removing the iris tissue, the pain could be relieved, the globe could be retained and often some sight as well. Physicians knew well the danger of opiates then as they do now, and undoubtedly sought to perform the operation with the least opiate. But the less opiate, the less toilet of the wound was possible, for the tissues were exquisitely tender. Chloroform was often used for general anesthesia; we all know how post-anesthetic retching and vomiting often disturb a perfect wound toilet. Undoubtedly many an eye was therefore left without a proper toilet of the wound; that is, portions of the iris torn from its root in the ciliary body were probably left in the wound. This fact undoubtedly worried many an eye surgeon, because for years it had been known that an eye injury followed by incarceration of uvea in a corneal or scleral wound often resulted in sympathetic ophthalmia and blindness in both eyes. But untreated

glaucoma also resulted in blindness, and when glaucoma caused blindness in one eye, it was apt to be followed by glaucomatous blindness in the other eye.

I have tried to show in the foregoing that there was an attempt by the ophthalmologists to break out of their bonds of ignorance. They would catch an idea, but, handicapped by their training and their lack of the scientific approach, they did not seem to be able to follow their ideas logically. Von Graefe brought a new viewpoint and stimulated many others to similar thoughtful consideration of clinical pathology, symptoms, diagnosis, and treatment. One of the first young men to react to his monograph on glaucoma was Coccius.

E. A. Coccius<sup>11</sup> noted in his thesis in 1859 that the iridectomy of von Graefe and the paracentesis operation were often only temporarily successful; the disorder often passed into a chronic stage characterized by progressive destruction of the optic nerve and blindness associated with recurrent and often continuous increase in tension. Coccius modestly announced: "We have had the good fortune to discover a new method of operating for chronic glaucoma. . . . It consists in this: in the iridectomy only a small part of the iris is cut off, the other part is left lying in the wound, so that the iridectomy is combined with an iridencleisis. . . . The iridencleisis may cause emphatically dangerous accidents but there is a decided difference here: whether a large piece of the iris shall be enclosed in a small wound (after which the well-known incarceration phenomena may appear); or whether a small piece of the iris shall be left lying in a large wound. In the latter case we have not observed inflammation; but the results for chronic glaucoma are of the kind to which no other method leads us; and we have also given up many drainage procedures which we thought necessary

(even so many as 30 in different spaces of time), when in spite of the foregoing iridectomy the glaucoma made further advances. We cannot overlook the fact that we have had favorable results with these methods. . . ."

Coccius's conclusion was: "The results of iridectomy cannot be compared with those yielded by iridencleisis; the main point is not to cut out a large piece of the iris but only to let a large flap of the iris be included in the incision. . . . Then this piece of iris can drain the aqueous to a larger degree than in any other possible way through the cornea."

The question at the time was not operation or medical treatment, as the value of miotics was not discovered until nearly 20 years later—that is, eserine, by L. Laqueur (1876), and pilocarpine by A. Weber (1877), although von Graefe had found the extract of calabar bean (physostigmine) useful.

Probably the next contribution that should be mentioned is that by deWecker, who, from 1867 on, wrote voluminously on many topics in ophthalmology, and in particular regarding drainage operations for glaucoma. His microscopic studies of glaucomatous eyes, many of which had been iridectomized, led him to believe that the reason why the operation was sometimes successful was that it produced fine filtering channels which drain away the aqueous that cannot escape through the spaces of Fontana. DeWecker reasoned that these drainage channels would connect the chamber with the veins, and if there were enough of them (about one fourth the corneal circumference), the tension would recede. At first he taught that *the iris should not be touched*. Later he modified his technique to include iridectomy of the root, so the iris would not cling to the posterior surface of the cornea and block the angle.

Litton Forbes<sup>12</sup> in 1879 translated de-

Wecker's "Ocular therapeutics." A few interesting quotations follow: "Glaucoma is 'the expression of a disturbance of equilibrium between secretion and excretion, with increase in the contents of the eye, and increased tension.'" On page 260, "It is now more than ten years since I insisted on the fact that the cure of glaucoma must be searched for in the reestablishment of filtrations through a suitable cicatrix. . . . I was the first to adopt the doctrine of impaired filtration." On page 266, "Congestion, where an eye is affected by senile changes and where channels of filtration are scarcely adequate to carry off the normal accumulation of fluid, will cause an increase in tension which, though slight, will be quite sufficient to establish the vicious circle I have already spoken of." On page 270 deWecker says that he neglects his own precepts in advising removal of the iris, but this is to obtain better drainage, free of complicating iris tissue. "In this operation, iridectomy is but a mere affair of cleansing the wounds in the capsule and cornea and especially in the iridic angle—the operation establishes between the veins and the anterior chamber a more direct mode of communication." A patient upon whom a drainage operation had been performed had found that whenever the eye became irritable and hard, by pressing upon it he could relieve the irritation and cause the eye to become softer; moreover as a result of this pressure, there was an edema of the conjunctiva (page 272). . . . Miotics had been introduced in 1876 and 1877 and deWecker at once made use of them, both preoperatively and postoperatively.

At the International Medical Congress in London 1881, Mr. C. Bader<sup>13</sup> presented a very short contribution and showed five illustrative cases under the title, "Sclerotomy in glaucoma." "In bringing before you the following cases

of glaucoma treated by sclerotomy, I wish to prove: (1) That the kinds of glaucoma usually treated by iridectomy can be treated more successfully by sclerotomy. (2) That to secure success, it is desirable to obtain, and to maintain, a staphyloma of the conjunctiva with or without a prolapse of the iris. These cases also show the truth of the second proposition, that is, the desirability of a staphyloma of the conjunctiva, with or without prolapse of the iris. I know of no better method to secure this than the kind of staphyloma by which a small scleral flap is made, close to the insertion of the iris, leaving part of the conjunctiva adjoining the scleral wound undivided. I consider the occurrence of prolapse of the iris a favorable accident, and the non-occurrence of staphyloma as an unfavorable symptom. All steps of the operation and of the after-treatment must tend to secure a bulging of the conjunctiva, or of conjunctiva and iris, as a safety valve to too high tension of the eye ball."

During the next 20 years there was, apparently, very little to interest us, in this connection. However, various seton operations were proposed. For example: At the VIII International Ophthalmological Congress (1894), H. Walker<sup>14</sup> read a paper which may be summarized as follows: After so many failures in curing glaucoma by iridectomy, he tried seton operations, using various substances, including muscle tissue, passing them into or through the anterior chamber.

In the spring of 1890, Walker succeeded in making a permanent fistula by means of inserting a flap of conjunctiva into an incision in the base of the anterior chamber. A tongue flap is dissected one-sixteenth inch by three-sixteenth inch with hinge near the limbus. Near the hinge an incision is made through the cornea, perpendicular to the plane of the iris. When the aqueous has been evacuated, the conjunctival flap is pushed into

the eye. The raw surface of conjunctiva will unite with the one raw edge of the corneal wound. The epithelial surface will not unite with the other edge of the corneal wound. Thus a fistula will be formed. The corneal incision must not be too large. Often the seton will have to be replaced on several postoperative days. The fistula may require occasional subsequent probing.

At the same congress (1894) Louis deWecker<sup>15</sup> read a paper on "Simple and combined sclerotomy." In 1867, the author says, he stated that the value of the iridectomy for glaucoma was in the section of the sclera, the iridectomy itself being of secondary importance. In 1894, M. Knies, at the Congress in Heidelberg (p. 118 of the report), stated: "Iridectomy is chiefly performed in order to prevent the prolapse of the iris, as adhesions forming between it and the cicatrix render the usefulness of the section questionable." Knies quoted Mauthner and Snellen as having abandoned iridectomy in favor of sclerectomy; also Bader, as encouraging prolapse of the iris in the scleral wound. "The ideal operation in glaucoma is evidently a large scleral incision combined with iridodialysis, running the whole length of the cicatrix formed in the trabecular pericorneal tissue." The idea of iridodialysis seems to date from 1787, when it was performed by Assolini. In Jungken's "Ophthalmic surgery" (1829) are found descriptions of no less than 19 different methods of performing iridodialysis.

A great forward step was taken at the turn of the century. Maj. H. Herbert<sup>16</sup> writing on "Subconjunctival fistula formation in the treatment of primary chronic glaucoma," said that this was a report of work done in Bombay, India, and he did not lay claim to originality. Practically all patients there are seen in the late stages of the disease. Iridectomy fails or destroys vision through compli-

cations. A large classical iridectomy in advanced glaucoma is apt to be complicated by loss of vitreous, expulsion of the lens, and retinal hemorrhage. More general success was found when by accident the iris healed in the wound, especially if covered by conjunctiva. Herbert therefore purposefully attempted in 130 eyes to make a small uveal prolapse under the conjunctiva, using a thin cataract knife. Some iris was removed in 8 of these only, in the other 122, the iris remained uncut. Results:

(1) Late infection, possibly one; two eyes were lost by bacterial invasion at time of operation.

(2) Relief of tension provided by a fistulous cicatrix appeared to be certain and permanent. In no single case had there been any question of a return to hypertension after free filtration had once become established. In a few eyes the immediate lowering of tension was followed by a period of slight hypertension lasting up to two to three months; in these eyes daily massage and occasional eserine did much to control the high tension and shorten its duration. There was little doubt that one should always combine a small iridectomy with the operation, in order to obtain what relief one could by the more recognized proceeding and to rely upon the weak scar only as a sort of safety valve. Especially should iridectomy be done if there is iris atrophy. "When it has become fibrous, tough, and inelastic, it much less readily undergoes the absorption necessary to admit of the passage of aqueous through it." Some eyes became quite soft, especially if the previous tension had been quite high. Probably this was due to atrophy of the ciliary body.

(3) Effect on vision was more favorable than could be expected of simple iridectomy. Herbert says, "I have not found the operation was liable to harm eyes with very contracted fields." In

nearly all cases there was a definite improvement in vision. In some cases deterioration progressed.

(4) Delayed refilling of the anterior chamber was due to: (a) too free leakage of aqueous; (b) deficient secretion of aqueous; (c) escape of vitreous at operation if the incision was too far back. Occasionally there was intraocular hemorrhage. Sympathetic ophthalmia was rare. Operation was done with a small thin Graefe knife (not with a keratome); a very oblique and small incision, 4 mm. (inside) was made in order to produce as small a prolapse as possible. Herbert operated without previous use of eserine. He felt it necessary to have some conjunctival edema result (so as to pit on pressure with a probe).

[The Schiötz tonometer was presented to the profession in March, 1905.]

Although Lagrange made repeated assertions that it was unwise and unsurgical to allow iris to be incarcerated in a scleral wound, our story would not be complete without a few references to his attitude and to his contributions, for he wrote extensively at the very time that iris-inclusion operations were being proposed. At first he was very much in favor of sclerectomy, but by 1907<sup>17</sup> he advocated the combined operation of iridectomy and *sclerectomy* (not *sclerotomy*) for chronic simple glaucoma. He maintained that a simple scleral incision with or without iridectomy was no more satisfactory than iridectomy itself, because the lips of the wound healed and did not continue to filter. He here reviews the contributions of Bader, Walker, Herbert, and Holth, their advantages and disadvantages (especially the dangers of sympathetic disease and infection) and then describes his own operation, which in brief, is as follows:

(a) Eserine instillation preliminary to operation to free the iris angle as much as possible so as to allow for better

section. This also would reduce the possibility of iris entanglement in the wound.

(b) Local anesthesia, combined with instillation of adrenalin.

(c) Incision with a thin Graefe knife; the puncture and counterpuncture should be made much as in a cataract operation but less extensive, and should be oblique and quite far out in the iris angle to include a scleral lip and a large conjunctival flap.

(d) Sclerectomy; when the flap is pulled down, the scleral lip must be removed without buttonholing the conjunctiva.

(e) "Iridectomy in the usual way"—Lagrange unfortunately does not give details about tearing the iris from the root or replacing the pillars; the pictures would indicate he did not intentionally leave iris in the wound.

A few months later, in the *Annals d'Oculistique*, is given the paper which Holth<sup>18</sup> presented to the French Ophthalmological Society: "Iridencleisis antiglaucomatosa."<sup>19</sup> Holth gives deWecker credit for showing that the filtering properties of the corneoscleral cicatrix constituted the active element of the operative treatment, and for being the first to substitute the anterior sclerotomy for the iridectomy. Holth began to do Graefe's iridectomy in 1891, but became dissatisfied with the results. About 1893 he began to notice that in certain cases, in spite of irregularities of cicatrization, the results were better; such cicatrices presented at one or both ends of the line of incision a small bulla or a diffuse edema of the nearby conjunctival tissues. These formations have been given the name, "cystoid cicatrix," or "filtering cicatrix," after the theory of deWecker. Holth explains: "The cause of these I have always found to be in the entrapment of the iris even when it was not visible at the level of the cicatrix. I

prefer the term 'fistular cicatrix,' as the entrapped part of the iris in the cicatricial tissue determines the fistulous tract. The cystoid cicatrix is not the same thing." Holth cites several examples of patients in whom one eye was correctly operated on and surgery on the other eye poorly done; the results of which were that the eye correctly operated on became blind, whereas the one poorly operated on retained the vision and a lowered tension.

On August 26, 1904, after having operated upon several animals, Holth finally had the courage to try out the idea of purposely incarcerating a fragment of iris in the angle of the wound when doing a subconjunctival iridectomy on a patient with absolute glaucoma. He mentioned his scruples: (1) Glaucoma can be produced in an otherwise well eye by anterior synechiae; and (2) infection. To meet the drawbacks: (1) He incarcerated the iris in the scleral part of the limbus, and (2) he made the conjunctival cover large and thick.

Holth's technique after several trials became the following:

(1) Local anesthetic combined with adrenalin.

(2) Lance knife (keratome). With the point he picked up the conjunctiva 5 to 8 mm. from the limbus, and entered the chamber 1 mm. behind the limbus. At times he did the operation with a Graefe knife, either (a) from above or (b) from the 2-o'clock or 10-o'clock position. In the latter case, (b), he would enter the conjunctiva 5 or 6 mm. from the limbus, enter the sclera  $1\frac{1}{2}$  mm. from the limbus, cross the chamber just anterior to the iris, reënter the angle and sclera, coming out in a symmetrical position on the other side, both through sclera and conjunctiva; he did not finish the scleral section as is done in the Lagrange operation. He could then do two iris-inclusion operations with the one scleral thrust.



(3) He preferred the corneoscleral wound to be short—not over 5 to 6 mm. long—and he usually used a stop keratome.

(4) In removing the keratome he was very careful to depress the heel and raise the point so as not to injure the lens.

(5) He grasped the iris either at the pupillary margin (if he wished to cut the sphincter) or more toward the periphery, withdrew the iris and cut it radially, using the deWecker scissors, but was very careful not to cut off the prolapse. Thus a portion of the iris was left attached (hinged) and this was drawn into a corner of the scleral wound.

(6) He did not use an iris spatula, as that injures the iris pigment epithelium.

(7) He did this operation on many eyes in which an iridectomy had previously been done.

(8) Occasionally a thin glassy bulla would form over the operative wound; this would be sharply outlined at the sides, indicating that the aqueous was not draining away freely into the nearby tissues. In such cases he would undermine the bulla from nearby and advocate massage. He attempted to produce a small edematous cushion over the corneoscleral wound.\*

In some cases the iris slipped back into the chamber; in others, no conjunctival edema was demonstrable even though the tension remained low; in still others miotics were of benefit postoperatively even though they had been almost useless preoperatively. Holth emphasized the necessity of avoiding operation so long as there was infection in the lacrimal passages. Occasionally pupillary synechiae formed, but no K. P. or other serious complications. He said Lagrange's success with sclerectomy with or without iridectomy

was probably at least in part due to post-operative rupture of the very large scleral wound, either momentarily with immediate reestablishment, or with hernia of a bit of the edge of the iris.

From 1909 to 1911, Johann Borthen<sup>20 23</sup> of Norway wrote about a variation in the iris-inclusion operation, which consisted essentially (1) in instilling atropine about 15 minutes before the operation, and (2) in omitting the cutting of the iris. One further difference in the technique was that Borthen *always* grasped the iris in the pupillary margin and pulled it out far enough so that the pigment layer of the prolapse would face anteriorly. He emphasized, first, that the iris should not be pulled *too far* out of the chamber, and, second, that the limbal incision should not be too large. If the iris is pulled too far out of the incision, the pupil will be dislocated too much, and if the incision is too large, the iris will retract into the wound. He named this operation "iridotaxis," because he said it was the pulling and stretching of the iris that produced the beneficial results.

"I believe that my operation, far from being a minor variation of Holth's procedure, casual and unessential in character, is, on the contrary, one which produces essential and radical changes in the mechanism of healing. Incision of the iris, iridotomy, may nullify the very effect, that of permanent drainage, which it was to promote. The very fact, on the other hand, that the iris remains uninjured, according to my suggestion, and is merely drawn out and stretched, may account for the excellent results as to filtration and fistulization with the attendant permanent reduction in tension . . . the radial arrangement of the fibers . . . the crypts appear longer, the contraction furrows smoothed out . . . the pupil drawn away from the center. . . . I believe this traction itself indirectly affects the ten-

\* He demonstrated in one case through a folding of the iris a small pigment-lined fistulous tract through the sclera, leading into the subconjunctival space.



sion, much in the same way as, but more actively than, eserine and active accommodation; there is increase of drainage through Fontana's spaces in direct consequence of the stretching of the iris. . . . The more rapid and effectual reduction of tension after iridotasis, as compared with the results of iridencleisis, would speak strongly in favor of this theory. The latter operation makes all stretching of the iris impossible and any reduction in tension is due to transcleral filtration solely. . . . Finally, it is worth noting that iridotasis may be ineffectual where the iris is atrophic, even if subconjunctival edema appears over the prolapse—probably due to permanent obliteration of the iris angle and atrophic changes in the stroma iridis. . . . In conclusion, I wish to lay stress on the importance of operating under atropine mydriasis, so that complete paralysis of the iris may prevent spontaneous reposition; the advisability of avoiding forcible traction on the iris after it has been brought through the scleral section, so as not to draw up the pupil; and the necessity of a somewhat more liberal scleral section, 8 mm. in very old patients with rigid iris."

To these statements, Holth<sup>24</sup> replied: Borthen seemed to think that the fistulous scar was not the explanation of the good results of the Holth operation; and that the drawing of the iris away from the opposite angle, the clearing of Fontana's space and the stretching of the iris tissue, were the important elements in the iridotasis. This, in spite of the fact that Holth had shown microscopic sections of seven eyes, demonstrating fistulization. In doing the Holth operation, Borthen used only one form (tongue form of the Holth operation, the least satisfying form) and he had done this only 16 times. Borthen excluded from his series, cases of inflammatory glaucoma, such cases as were included in Holth's original contribution. Borthen also called cured, cases with a

tension of 30 mm., whereas Holth put these in the only partially successful group, that group requiring postoperative miotics. Furthermore, Borthen did not make mention of the fact that the tension of an eye is reduced after several trials with the tonometer; Holth reported the tension after the first trial and Borthen possibly after several trials. Borthen disregards as unimportant in normalizing the tension the very evident cushion of the conjunctiva opposite the scleral incision. This cushion may be nonexistent if the communication channels lead directly to Tenon's capsule. He does agree that Borthen's suggestion of atropine immediately before the operation is a good one. Holth's operation never dislocates the pupil, and can be used in cases of atrophic iris, in which cases the Borthen operation is of little value.

David Harrower, of Worcester, Massachusetts,<sup>25</sup> was apparently the first in the United States to try, or at least to write about his experience with the iridotasis operation. His paper was read at the American Ophthalmological Society meeting in Washington, D.C., in May, 1913. He quotes Borthen as saying it was an improvement over the operation of Holth (1907), called iridencleisis, or iris incarceration.

Harrower agreed with Borthen as to the inadvisability of incising the iris, believing this portion of the operation to be unnecessary. He was convinced that the same effect could be produced by inclusion of a fold of iris, allowing the posterior surface to coalesce with the subconjunctival tissues thus assuring a position of the sphincter external to the section, and, with this, free drainage. This modification had the advantage of avoiding a step of the operation, incision of the iris, which requires skillful technique and a good assistant to hold the conjunctival flap down on the cornea during iridotomy. This idea was suggested to Borthen by the

observation of a case of rupture of the corneoscleral margin by blunt violence with incarceration of the iris under the uninjured conjunctiva. Tension was subnormal and the eye free from irritation; this condition remained unchanged as long as the patient was under observation. Borthen's operation is intended to produce the very condition observed in this case.

The operation (still quoting Harrower) is performed as follows: The conjunctiva is grasped with fine straight forceps about 10 mm. behind the upper limbus, and a cut 2 to 3 mm. long is made in the raised conjunctival fold with ordinary iris scissors. The scissors are then carried toward the limbus, dissecting a conjunctival flap and keeping as near to the scleral surface as possible in order to include a large amount of subconjunctival tissue in the flap. Care must be taken to avoid fenestrating the conjunctiva near the limbus, as this would not only expose the incarcerated iris to infection, but interfere with filtration as well. The globe is now held with fixation forceps, and the lance knife with stop introduced about 1 mm. behind the corneoscleral margin, and carried down through the anterior chamber until the section is 4 to 5 mm. long. The conjunctival flap can be made by means of the lance knife when making the incision, but the dissection with the scissors insures the inclusion of subconjunctival tissue in the flap, and he believes this is a matter of practical importance for filtration and the formation of a subconjunctival bleb. The iris is now grasped at the sphincter with the iris forceps, taking up a fold 1 mm. wide; it is drawn out through the section and left there. . . . A drop of atropine, instilled 10 minutes before operation, will insure the permanency of the prolapse, and does not cause increased tension.

Harrower reported two cases. In the discussion, 6 or 7 of the prominent mem-

bers either condemned the procedure as most dangerous, or were very skeptical, Edward Jackson only being kindly disposed. Critchett's operation "iridodesis" was mentioned by Samuel Theobald of Baltimore.

A few years later,<sup>26</sup> in 1917, Harrower gave another paper entitled "Five years' experience with iridotaxis," before the same Society. By that time, he had performed the operation on 23 eyes. He had varied the technique only slightly by using dissecting scissors and hugging the sclera. In the discussion which followed, it developed that he had not tried the recent modification made by Borthen of buttonholing the prolapsed iris.

Numerous other papers have appeared in the American literature, notably, two by Dunbar Roy,<sup>27, 28</sup> one each by W. H. Wilder,<sup>29</sup> Clapp,<sup>30</sup> Muncy,<sup>31</sup> Constantine,<sup>32</sup> Works,<sup>33</sup> Ziporkes,<sup>34</sup> and Greenwood.<sup>35</sup> Also in the 1933 British Transactions of the Ophthalmological Society of the United Kingdom appears an extensive article, by Holth<sup>36</sup> and one by Wright.<sup>37</sup> There are other contributions also, but none of them has developed material alterations in the technique, and their results for the most part confirm the claims in the earlier papers.

Dunbar Roy reported five cases in 1916. In four of these cases both eyes were operated upon. He mentioned the fact that he had been told Borthen had discontinued the operation, so he wrote him and this is part of Borthen's reply: "Since 1908 I have in all performed iridotaxis in 242 cases, with so highly satisfactory results that I have not felt inclined to try any other. I am convinced that the reduction of tension is due, not to filtration, but to increased drainage through Fontana's spaces in direct consequence of stretching of the iris. It is quite unnecessary to make the conjunctival flap larger than just sufficient to cover the incarcerated iris."

Wilder's contribution gives a condensed report of 36 consecutive cases. From my many years' association with him I know how insistent he was on the production of as thick a flap of conjunctiva and episclera as possible, whether he did the iridotaxis of Borthen or the iridencleisis of Holth.

Allen Greenwood combined a sclerectomy with iridencleisis or with iridotaxis if the tension was unusually high or apt to go high. He made a very oblique scleral incision, beginning farther back than was formerly advocated and entered the anterior chamber as far in the angle as possible. He thus had a shelf of sclera quite like that produced by the Lagrange incision, which shelf could be cut off or punched with Holth's punch forceps. He then followed by incarcerating the iris in one or both corners of the scleral wound. "No postoperative massage is necessary."

In 1922 Schlosser<sup>38</sup> wrote of a minor change in technique which he said he had been using since 1904. He made a narrow Lagrange sclerectomy as much under conjunctival cover as possible with almost no cutting of the conjunctiva itself. He would prolapse the iris by pressure on the globe. If this was unsuccessful he would grasp it in the middle zone with forceps and pull it well into the wound, and then use scopolamin. A binocular bandage was used for 24 hours. It might be necessary to transfix the prolapsed iris 10 to 14 days later.

The development of the iris-inclusion operations was retarded from time to time by statements of men high in the ranks of ophthalmology, men whose very name commanded confidence. For instance, Paul Roemer,<sup>39</sup> professor of ophthalmology at Greifswald, made these statements since Holth's contribution in 1907:

"The formation of a conjunctival flap is to be avoided because, in the first place,

the vessels there are apt to bleed considerably, and, in the second, a conjunctival flap favors the formation of a cystoid cicatrix. . . . If a tag of iris is caught in the angle of the wound we try to seize it with forceps and abscise it, or we may introduce a small spatula and push it back into the normal position. Such incarcerations of the iris are dangerous, because they delay the healing of the wound, or render the regulation of the tension difficult" (p. 498). [I have no doubt that he had tried the Herbert operation in somewhat the manner I have seen that operation done—that is, with a small conjunctival flap which is dissected down to the limbus on each side, thus inviting a tight cicatrix around the prolapse. I have noted in many descriptions of the operative technique of opening the anterior chamber with a keratome that the point of entrance was 1 to 1½ mm. behind the clear corneal border in the 12-o'clock meridian. This position in my experience is apt to be too far forward, depending somewhat on the prominence of the limbal vessels. Many operators do not thrust the keratome through the limbus perpendicularly to the cornea for fear of injuring the iris and even the zonule of the lens; when they do, it usually enters the chamber 0.5 mm. or more in front of the pectinate ligament. Such eyes examined later with the gonioscope are found to have iris tissue at each side of the coloboma adherent to the pectinate ligament, often also to the cornea itself, thus effectually blocking the entrance to the Schlemm canal (T.D.A.).]

Elliott<sup>40</sup> condemns all iris-inclusion operations with this remark: "It seems strange that a procedure which is so obviously unsound can find any advocacy at the present time. Much as the author desires to avoid any suspicion of intolerance and bigotry, he feels that there are certain operative methods which are seri-

ously entertained today, which stand self-condemned at the bar of modern pathology and surgery. The effort to produce the entanglement of iris in a scar is, in my opinion, one of such."

Berens<sup>41</sup> criticizes severely all inclusion operations with these words:

"(1) It is unsound in principle, for in all other intraocular operations or in penetrating injuries, it is found that eyes in which there is iris entanglement or a prolapse, remain irritable longer than those in which these complications are absent, and every care is taken to avoid them.

"(2) Iris prolapse is one of the chief factors in the causation of sympathetic ophthalmitis.

"(3) Late infection after trephining is frequently if not always, associated with entanglement of uveal tissue in the wound."

On the other hand deSchweinitz<sup>42</sup> is somewhat noncommittal.

"One of the complications which may follow the operation of iridectomy in glaucoma is the formation of a bulging scar at the seat of the incision, sometimes called a cystoid cicatrix. This is especially true if due care has not been taken to free the angles of the wound from adherent iris. On the other hand, in severe cases, this very cystoid cicatrix, by permitting a filtering of the liquids, has been regarded as a favorable condition. In this condition the modern operations for the relief of glaucoma, by means of which a filtering area is produced, must be considered. They are discussed on p. 629." After considering several sclerectomy operations in some detail he gives about 12 lines to the iris-inclusion operations.

Fuchs's textbook<sup>43</sup> (Duane translation) contains this sentence (with reference to iridectomy): "Incarceration of the iris in the wound after operation should be avoided by careful reposition." And on

page 983 Duane adds an 11-line paragraph on iridotaxis, without any comment. He mentions Holth's punch forceps operation but not his iridencleisis.

Gjessing,<sup>44</sup> in 1939, advocated the iridencleisis operation but, preliminary to doing it, he takes about 400 c.c. of blood by phlebotomy. And finally Ballantyne<sup>45</sup> sums up the situation in his paper, "The choice of operation in glaucoma" by comparing the operative procedures advocated from the time of George Critchett and Coccius on, with the conclusion that the choice of operation depends on many factors. He does not favor iridotaxis, as he thinks the sphincter should be preserved, both because of the frequent necessity to continue miotics and because it gives a better cosmetic result.

#### SUMMARY

In this article an attempt is made to show the methods used by the early ophthalmologists to relieve suffering and postpone blindness; first, in the prescientific era from approximately 1800 to 1850; second, in the early scientific era from 1850 to 1900; and finally in the last 40 years.

During the first period, diagnosis was very crude, medical treatment was very severe, and surgical treatment was done in an empiric manner.

In the second period, as a result of more exact methods of examining the living eye, as well as the enucleated eye, there was an improvement in the technique. This was aided by an international interchange of opinions by the leaders in various countries. As a result of this certain opinions, which had been considered true, had to be questioned. Clinical observations improved in quality, and, from the second stage, gradually is evolving the third stage of more exact diagnosis and more logical treatment.

Several operations such as the trephine

and cyclodialysis have hardly been mentioned because in advocating them the authors have never suggested that iris be included in a scleral section; in fact meticulous avoidance was impressed upon all who would attempt them.

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# CLINICAL APPLICATION OF THE SCREEN (COVER) TEST DESCRIBED IN DETAIL

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Any test used for the determination of imbalance of the ocular muscles must be: (a) accurate, (b) precise, (c) quickly applicable in a large percentage of cases. It should make possible: (d) the measurements of tropias as well as of phorias; (e) the measurement of the amount of deviation when suppression is present and binocular vision is impossible. (f) It should be accurate in children too young to appreciate double images as required by many of the tests. (g) The more objective and the less subjective a test the better.

Many of the tests in vogue are purely subjective and measure only the phorias and the lesser amounts of tropias when suppression is not present.

Most tests are used to measure the deviation for distance only, while some are used to measure it for distance and near, but only in the primary position. If a measurement is desired in the six cardinal fields, an entirely different test is necessary, which may alter the fusion tendency entirely. This is not so with the screen test.

Duane, in an article on the parallax test, written in 1895, stated: "As far as my experience goes, the impulse towards bringing two dissimilar images into line is almost as strong as when the images are alike." This has been the writer's experience in many cases, so many, in fact, that one is not safe in relying on any test which depends entirely on dissimilar images. The difference between these tests and the screen test is that the screen test measures more nearly the total amount of deviation, whereas the other tests measure only the amount that cannot be overcome, or the amount that

the deviation is increased or decreased by the convergence action in binocular vision. This may vary by many degrees in different individuals or in the same individual at different times.

Before considering the application of the test, it would be better to consider the normal physiologic function of the ocular muscles.

One has to consider, first, the action of each individual muscle *per se*. Second, the action in associated movements as controlled by the cortical or subcortical area. Third, the act of convergence as controlled by the convergence center. Fourth, the function of divergence as controlled by the divergence center. Fifth, the function of sursumvergence with strong evidence of a center controlling the vertical adjustments, and, sixth, the function of rotation as shown by the position of the vertical meridians of the corneas.

The outer wall of the orbit forms an angle of 45 degrees with the nasal wall, and with the visual axis of the eye in the primary position, an angle of 26 degrees.

Consider each eye as moving on three axes—a vertical axis for inward and outward rotations; a horizontal axis on which the eye elevates or depresses; and an antero-posterior axis on which the eye is intorted or extorted. Listing's laws (see page 29 in "Duane's Thesis") may all be proved by this concept but are unnecessary to clinical ophthalmologists. The external rectus and the internal rectus are the only muscles that have at all times a straight line of traction and hence an uncomplicated action of abduction and adduction and act only on the vertical

axis. Since the superior and inferior recti have their origins at the orbital foramen, the direction of each muscle is forward and outward. This causes the muscles, when the eye is in the primary position, to make traction at an off axis of approximately 26 degrees. Considering the eye as rotating on a vertical, horizontal, and antero-posterior axis, such an angular action would cause the superior rectus to elevate the eye on the horizontal axis, to adduct the eye when acting on the vertical axis, and to intort the eye by the action on the antero-posterior axis. The inferior rectus in the primary position depresses the eye on the horizontal axis, adducts on the vertical axis, and extorts on the antero-posterior axis. Since there are these three actions of each muscle in the primary position, the actions would be simplified if the traction could be made straight. This can be done by rotating the eye to the outer canthus, mainly by the action of the external rectus. In this position, the superior rectus, having a straight line of traction, is practically a pure elevator. The inferior rectus, working parallel to it, would then, in this position, be a pure depressor.

Since the effects of duction and torsion are caused by the off-axis tractions; these effects would be increased as the angle of the traction is increased. This would be in the nasal field.

A like condition is present in the case of the oblique muscles, except that the off-axis pull is about 43 degrees. In the primary position the inferior oblique elevates the eye on the horizontal axis, abducts on the vertical axis, and extorts on the antero-posterior axis. The superior oblique in the primary position depresses the cornea on the horizontal axis, abducts on the vertical axis, and intorts on the antero-posterior axis. When the cornea is well in the nasal field, these two muscles have almost a straight line of

traction. Hence, in this field, the inferior oblique is almost a pure elevator, while the superior oblique is almost a pure depressor.

Since, in the primary position, the elevators and depressors each have three functions, making 12 functions to watch in each eye, or 24 in all, and, added to this, the function of associated movements, convergence, divergence, and sursumvergence, it is small wonder that the question becomes complicated. It seems reasonable to assume, however, that if an elevator or depressor in underacting or overacting, as such, it is doing the same thing in its other functions; hence, if, for instance, a superior rectus fails in elevating the cornea in the temporal field, one can assume that the underaction is also present in the function of adduction and intorsion in the nasal field, and all functions are least affected in the primary position. All one needs to do, then, is to test the elevators and depressors in the field in which the act of elevation and depression is greatest, and the diagnosis is made from the comparative amount of elevation or depression of the eyes alone, disregarding their secondary actions of torsion and duction.

#### EXOPHORIA AND EXOTROPIA

With these physiologic actions of the extraocular muscles in mind, what could be the cause of an exophoria? It could be brought about by the weakness of one or both interni, or by an overaction of one or both externi. It could also be produced by an underaction of the convergence power with normal interni in their functions of adduction. It could also be caused by an excess of the divergence function. In itself, then, the finding of an exophoria means nothing until the test is repeated for the near point. It still means little unless the test is made when the eyes are turned to the right and to the left. If



the exophoria or exotropia is greater for distance than for near and does not increase in looking to the right or to the left, a diagnosis of a primary divergence excess can be made. If the exophoria or exotropia is greater for near than for distance, a convergence insufficiency or paralysis is the primary lesion, again provided that the deviation does not increase when the eyes are turned to the right or left. If the divergence of the visual axes increases in looking to the right, there is a paralysis, more or less marked, of the left internus or, more rarely, a spasm of the right externus. If the deviation increases in looking to the left, the conditions are reversed; that is, a paralysis of the right internus or a spasm of the left externus. If the exophoria or exotropia increases in looking to both the right and to the left, there is a paralysis of both interni. The exophoria or exotropia of a divergence excess or of a convergence insufficiency is never more, and usually it is less, in looking to the right or left than it is in the primary position.

#### ESOPHORIA AND ESOTROPIA

An esophoria may be due to a weak power of divergence that is divergence insufficiency or to paralysis; to a too-powerful converging power (convergence excess or spasm), or, again it may be due to a weak external rectus or to a too-powerful internal rectus.

This may be determined by measuring the amount of deviation for distance, near, and when looking to the right and to the left.

#### HYPERPHORIA AND HYPERTROPIA

If a right hyperphoria is found by any test in the primary position, what does it mean? The test shows only that the right eye is higher than the left eye. This may be produced by an excessive power of sursumvergence, to an underaction from

any cause of the depressors of the right eye, or to an overaction of the elevators of the same eye. It could also be brought about by an underaction of the elevators, or by an overaction of the depressors of the left eye. In a left hyperphoria, the reverse is true. To determine which muscles are involved, the deviation must be measured in the upper and lower corners. This, to be sure, tests the associated muscles in their respective fields as elevators or depressors only, but if found defective, or excessive, as such, they are over- or underacting in their secondary functions of duction and torsion, as has been previously stated; although these functions seem in many cases to be compensated for by the action of the other muscles. Primary paralyses are very common, whereas primary spasms are seen quite infrequently. However, secondary contractures of direct antagonists and secondary deviations of the associate muscles are very common.

It is necessary, then, in order to make a definite diagnosis, to know not only the amount of deviation for distance and for near, but also in the six cardinal positions as well. The screen test is most satisfactory, as all measurements can be made by it. This should be followed by the screen-comitance test, to be described later.

#### REQUISITES FOR MAKING SCREEN TEST

*Source of light.* Light must be diffuse, so that the examiner may clearly see the cornea, pupils, and the movements of the eye; free from glare and brilliance, so that patient and examiner are not blinded nor disturbed in any way by the light. This test is purely an objective test and depends entirely on the observations of the examiner.

*Size and position of test object.* The test object must be large enough to be seen at the desired distance. The usual

position is at 20 feet for distance, 33 cm. for near, for the eyes front position. A diagnosis is often aided by making tests at 15 feet, 10 feet, 3 feet, 0.5 m., and 0.25 m. It also is important in some cases to make tests at 50, 100, and 200 feet. These variations are especially important in convergence excess and spasm and in divergence insufficiency and divergence excess.

When examining in the six cardinal positions, one should hold the test object at 50-75 cm., but in the same relative position, since the relation of one position to another is more important than the actual amount of the deviation. In paralytic cases, the test object must always be held just within the point of possible fixation. In paralytic cases, especially, one must watch corneal reflexes and movement to fixate, since the patient may prefer eccentric fixation. This is especially so if a bright light is used as the object to fixate, in which case it is better to use a dim light, or some object that the patient must fixate centrally. The size and brilliancy of the object must be reduced in order better to study the effects of the accommodation; for example, small type or other objects that would require more accommodative effort for either distance or near or for both.

*Screen or cover.* The most satisfactory screen is 6 by 15 or 18 cm. It must be so large that the examiner does not need to watch its position carefully. This enables him to pay more attention to the movements of the eyes. The small round screens or complicated screens are not recommended.

*Position.* The screen should be held so that it comes directly in line of the object to be fixated but held far enough in front so that the covered eye can be seen by the examiner. It should be held so that when

moved to the other eye, it does not touch the end of the nose. One-half to one inch is usually enough. To place the screen close to the eye prevents the examiner from observing the covered eye, slows down the test, and is unpleasant to the patient.

The screen should be moved almost entirely by wrist motion, as in casting a fishing lure. It should be moved no faster than the examiner can see the patient change fixation. This depends on macular vision and the ability to fixate, also on the coöperation and concentration of the patient.

*Prisms to be used.* The most satisfactory prisms are the square unmounted prisms, about 4 by 4 cm. in size, increasing from  $1^{\Delta}$  to  $10^{\Delta}$  by  $1^{\Delta}$ , from  $10^{\Delta}$  to  $20^{\Delta}$  by  $2^{\Delta}$ , and, in addition,  $30^{\Delta}$  and  $40^{\Delta}$ . A  $50^{\Delta}$  prism is on the market but is not recommended, since it must be held most accurately in order to avoid total deflection. With more than  $40^{\Delta}$  of deviation, it is better to divide the prisms, as for example, to correct  $60^{\Delta}$  place a  $30^{\Delta}$  before each eye or to correct  $70^{\Delta}$  place a  $30^{\Delta}$  before one eye and  $40^{\Delta}$  before the other. When large amounts of deviation are present an assistant or the patient himself may hold part of the total prism correction before one eye while the examiner holds the remainder before the other. A prism bar or a rotary prism is not advised for this test. Prism should be held in the symmetrical position (an equal amount of slant on each side of the prism), or the postero-normal position, where the flat face of the prism is next the eye and the slanting face in front.

An objection made to the prisms on the market is that they are not scientifically perfect. This has been found to be true, but since a diagnosis depends on the relative amounts of deviation for distance, near, and in the six cardinal directions,

rather than on the precise number of degrees, the factor of inaccuracy does not influence the diagnosis.

#### TECHNIQUE OF LEARNING THE SCREEN TEST

Select a person with little or no deviation. Hold a prism base out before either eye and screen until a reversal is produced. Then hold the same prism base in, base up, and base down, until a reversal is produced. Reduce the strength of the prism until  $1^{\Delta}$  or  $2^{\Delta}$  is seen to cause a reversal.

If this practice is used, one is soon able to see and even estimate quite accurately the amount of deviation and is soon able to judge an approximately correct prism on the first few movements of the screen. The screen test is tedious and tiring and time consuming unless this technique is acquired.

The examiner, if presbyopic, should use a strength of glass of about that used for piano or cards. A high bifocal is preferred, so that the examiner need not throw his head back to use his near addition.

#### *Combined lateral and vertical deviation.*

If there is a combined lateral and vertical deviation, the prism should be placed base in or base out to correct the lateral deviation, together with a prism, base up or base down, to correct the vertical deviation. This cannot be accomplished as satisfactorily by any other test used in any way. When examining in the six cardinal fields, the examiner should hold the prism as accurately as for the primary position, but always so that the eye or eyes before which the prisms are placed are surely fixating the test object.

*Changing prism behind the screen.* Not infrequently more deviation develops by more completely breaking up fusion. This

is done by keeping one or the other eye constantly screened. The increasing amount of deviation is measured by increasing the strength of the prism before either eye, before moving the screen to the opposite eye. This may be done in any position of gaze.

*Kinds of deviation.* Deviations may be due to the underacting or the overacting of muscles for any reason. They may be due to anomalies of associated movements from cortical or subcortical areas. They may be due to anomalies of convergence, divergence, sursumvergence, or rotations. The examiner must determine which one of these functions is at fault, or whether the deviation is due to an overaction or underaction of one muscle or function, or to a combination of two or more muscles and/or functions.

*Orthophoria.* In true orthophoria, a screen placed before one eye will not cause it to deviate from the object fixated by the fellow eye. When the screen is moved to the fellow eye, there will be no movement of redress.

*Esophoria and Esotropia.* When the right eye is covered, it may be seen to converge behind the screen, while the left eye fixates. When the screen is moved to the left eye, the right eye rotates outward to fixate (movement of redress); this is an homonymous screen. With the right visual axis turning to the left or the left visual axis turning to the right, behind the screen, the eyes are in a position to have homonymous diplopia. The patient may observe the test object moving in the opposite direction to the movement of the screen; this is an homonymous parallax. If either eye when uncovered remains in a convergent position, an esotropia is present. This may be a truly alternating esotropia, or either eye may

be chosen to fixate, showing a right esotropia or a left esotropia. However, if the fixating eye remains fixed when on removal of the screen the other eye moves out to fixate with its fellow, an esophoria is present. These observations should be made not only in the eyes-front position, for distance and near, but also in the six cardinal fields, as fixation may change as the gaze is directed to different positions. Esophorias and esotropias are measured by placing the prisms, base out, until the redress is entirely stopped. If just over corrected,  $1^{\Delta}$  or  $2^{\Delta}$  should be deducted.

*Exophoria and Exotropia.* If, on covering the right eye, it is seen to diverge behind the screen and the redress is a movement in, to fixate, an exophoria or exotropia is present. If, on removing the screen, both eyes are seen to fixate, the deviation is an exophoria, but if one eye diverges while its fellow fixates, there exists either a right exotropia, left exotropia, or alternating exotropia. If diplopia were present, it should be a crossed diplopia, since the visual axes diverge. On moving the screen from one eye to the other, the eye follows the screen (crossed screen). The test object should be seen by the patient to move in the same direction as the eye or screen (crossed paralax). These should coincide and be measured with prisms, base in.

*Hyperphoria and Hypertropia.* The terms hyperphoria or hypertropia, and hypophoria or hypotropia, are confusing terms and cannot be used properly until a diagnosis is made. When the diagnosis is made, these terms are inadequate to describe the condition. A right hyperphoria means only that the right eye is the higher of the two. This may be produced by an underaction of either depressor of the right eye or to an overaction of either elevator. The right eye may

again be higher because the left eye is not high enough. This could be caused by an underaction of either elevator of the left eye or to an overaction of either depressor.

When a right hyperphoria is found to be caused by a paralysis of the left superior rectus, it is a left hypophoria, which tells but little, but when called a paralysis of the left superior rectus, one knows at once that the deviation increases in eyes up and left. The writer uses the term Hyper, designating whether it is a right hyperphoria or hypertropia, or a left hyperphoria or hypertropia.

If when screening the right eye, the eye is seen to be up behind the screen, or is seen to come down when the screen is moved to the other eye, a right hyperphoria or right hypertropia is present. If, on removing the screen, the left eye remains fixed, and the right eye lowers to fixate with it, a right hyperphoria is present. If the right eye remains high, or if, when it comes down to fixate, the left eye goes still lower, a right hypertropia is present. If double vision is present, it is a DR (right diplopia) with the image of the right eye lower. The patient should observe the image dropping (right paralax). The reverse is true in a left hyperphoria or left hypertropia.

Double hyperphoria or double hypertropia is frequently observed. When the screen before the right eye is moved to the left eye, the right eye is seen to come down to fixate. However, when the screen is moved back to the right eye, the left eye comes down to fixate. This proves a double hyperphoria or hypertropia. This is measured by placing prisms, base down, before the right eye until the downward movement of this eye is stopped. Little attention is paid to the left eye, while the right hyperphoria is being measured. Then prisms are placed, base down, before the left eye until all downward

movement of this eye is stopped. Double hyperphoria and hypertropia in the writer's belief proves a paralysis, more or less marked, of the corresponding elevator or depressor of each eye. Double hyperphoria may remain such if, for example, there is an equal paralysis of each inferior rectus, even though this is marked, but when the right inferior rectus (for example) is more paretic than the left inferior rectus, a right hyperphoria or hypertropia is dominant. An esotropia or an exotropia is frequently present. These should be corrected by prisms, base out or base in. The choice of the fixating eye may change the picture considerably when the deviation in the six cardinal fields is measured.

*Primary deviation.* When the nonparetic eye fixates normally, the paretic eye lags behind. The paretic eye is said to have a primary deviation.

*Secondary deviation.* When the paretic eye is required to fixate, the fixation is slower than normal, with a nystagmoid or jerky movement. This requires a special attempt to innervate the paretic muscle. The nonparetic eye, receiving the same amount of increased innervation, is markedly overacting (secondary deviation).

When more prism is required before one eye or the other in measuring deviations, the eye requiring the more prism is usually the nonparetic eye, and measures the secondary deviation. The paretic eye requires less prism. This observation is quite accurate in studying primary and secondary deviations.

*Secondary contractures.* A secondary contracture is developed when the nonparetic eye is more constantly the fixating eye. The direct antagonist to the paretic muscle is not restricted in its movements,

and overacts more and more. For example: If the right inferior rectus is paretic, and the left eye is more constantly used to fixate, the right hyperphoria which at first is only in eyes down and right, increases in eyes up and right, due to a secondary contracture of the right superior rectus.

*Position of test object in paretic cases.* When using the screen test in the six cardinal fields, it is very important to keep the test object within the limit of possible fixation.

*How much deviation can be measured by screen test?* With coöperation and normal fixation, amounts of strabismus to 80<sup>d</sup> or 100<sup>d</sup> may be accurately measured. Care should always be taken to avoid total deflection.

*Age of Patient.* The amount of deviation can be estimated in a child of one year, and accurately measured before three years of age, if the examiner uses the proper child psychology and patience, with the test objects something that will hold the child's attention. The screen comitance test to be described later may be used in the six cardinal fields, with much success, at a very early age, by using a nursing bottle, toy, or some attractive object, which should be changed when the attention lags.

#### PARALLAX TEST

The parallax test is a subjective test and so is dependent on the coöperation and observations of the patient. Some patients have no trouble in observing the movement of the test object, whereas others are quite stupid about it; and this is often in inverse proportion to the amount of intelligence or education of the patient. It is a very delicate test when properly observed, and again is quite tedious and valueless when complete co-

operation is lacking. The writer uses it much less than formerly. The test is conducted at the same time as the screen test. As the examiner observes the eye moving, the patient is asked if he sees the test object move. When the eye reverses movement by the screen test, the patient should see the object reverse movement. For example, if the right eye diverges behind the screen, the eye is in a position to have a crossed diplopia and as the screen is moved to the left eye, the patient's right eye moves to the left and picks up the object which has seemed to him to have moved to the left. This is termed a crossed parallax. An homonymous parallax is observed in an esophoria or esotropia; a right parallax in a right hyperphoria or tropia; and a left parallax when the left eye is higher. The test is extremely sensitive in many patients with a slight hyperphoria and is often observed in amounts of less than 0.5<sup>A</sup>.

When the examiner sees the eye move in one direction, while the object seems to the patient to move in the opposite direction, it is termed a perverse parallax. This is observed chiefly in postoperative convergent strabismus, and is due to faulty projection. The test object should be flush with the background to prevent a normal parallax.

The youngest child to give an unsolicited answer to the test was 2½ years old. He said immediately that the light dropped down in a right hyperphoria. The test depends more on the power of observation than on the age or intelligence of the patient. When the screen and the parallax fail to correspond, an abnormal retinal correspondence is present. In observing patients, degrees of 0.5 or 0.25 degrees of arc or even less are observed.

#### SCREEN-MADDOX ROD TEST

This test was described by Maddox in 1898, and by others since. It is a most

delicate and valuable test in slight phorias and tropias, especially hyperphorias.

The Maddox rod is placed before the right eye and the patient asked to fixate on a spotlight or candle. A screen is then placed before the rod to break up fusion still further. When the screen is removed, a right hyperphoria, which has been present, may have increased. A prism is then placed behind the screen and before the rod, of sufficient strength to cause the image of the rod to pass through the light when the screen is first removed.

When the rod is placed before the left eye, a right hyperphoria may still be found but may be somewhat greater or less than before. Usually the eye showing the greater hyperphoria or hypertropia of the same kind indicates a secondary deviation or secondary contracture of this eye. The screen-Maddox rod test may also be used to measure esophorias or exophorias but is not so reliable as the screen test alone.

However, and not infrequently, when the rod is placed before the left eye, a left hyperphoria is observed, whereas a right hyperphoria was found with the rod before the right eye. One is now dealing with a double hyperphoria and careful measurements in the upper and lower corners will reveal a paresis of a pair of elevators or depressors, the same muscle in each eye being parietic. For example, while in the primary position, there was a 1 prism degree of right hyperphoria when the rod was over the right eye, there was a left hyperphoria of 1 prism degree with the rod before the left eye. A left hyperphoria of 3 prism degrees was found in eyes up and right, while in eyes up and left there was a right hyperphoria of 3 prism degrees; other fields being normal, there is proved a slight paresis of both superior recti, and the use of the screen-Maddox rod before each eye in turn was the means of finding it. Again,

When the right hyperphoria so measured in the primary position is 2 prism degrees and the left hyperphoria is 3 prism degrees, it will be found that the left hyperphoria in eyes up and right is greater than the right hyperphoria in eyes up and left, proving the right superior rectus to be the more paretic. Definite relief of symptoms may be obtained by prescribing the difference in amount—in this case, 1 prism degree. This is better placed before the eye showing the larger amount of hyperphoria.

#### SCREEN-COMITANCE TEST

In the screen-comitance test, the screen is held in such a way that while the patient sees the object with only one eye at a time, the examiner is observing the movements of both eyes. This test should be made in the six cardinal positions and may be made at the same time as the screen test, but is better made as a separate observation.

When making the test with the sound eye fixating, the paretic eye is seen to lag (primary deviation). When fixating with the paretic eye an extra stimulus is necessary to fixate an object in its normal field of action; the associate or yoke muscle of the other eye receives the same added impulse and overshoots. This is termed secondary deviation and is always greater than the primary deviation. Usually the greater the paresis, the greater the secondary deviation. In extreme cases this is not so, since the muscle may be so paralyzed that fixation is not attempted and hence the secondary deviation is correspondingly small, or lacking entirely.

#### MOVEMENT OF REDRESS

The examiner screens the right eye, which is seen to be in a position of convergence behind the screen. When the screen is moved to the left eye, the right

eye comes out to fixate (movement of redress), while the left eye is turned in behind the screen.

The movement of redress is the attempt of the patient to change fixation when the screen is passed from one eye to the other and a prism of the correct amount will stop all movements. Occasionally the uncovered eye—for example, in an esotropia—will swing out sharply and too far, and in order to fixate the test object, the eye must come in. Since the first movement was outward, the esotropia is still undercorrected and more prism must be placed, base out, until the first movement is that of a crossed screen. This is observed also in exotropias and hypertropias.

#### HOMONYMOUS SCREEN

When the covered right eye is turned in behind the screen, it must come out to fixate when the screen is moved to the left eye. This is an homonymous screen and is measured by placing prism, base out, before one eye or the other, or in deviations of over 40 prism degrees, by using prism, base out, before both eyes until the deviation is just overcorrected. The visual axes are in the position to have an homonymous diplopia. The patient would see the object move in the opposite direction to the screen, homonymous parallax.

#### CROSSED SCREEN AND PARALLAX

When the eye that is screened turns out, there is an exophoria or exotropia. The examiner determines which and measures the amount by a prism placed base in. This patient should have a crossed diplopia and moves the eye in to pick up the object on the opposite side (crossed parallax).

#### VERTICAL SCREEN AND PARALLAX

If the right eye is higher behind the screen, there is a right hypertropia or



right hyperphoria. A prism is placed base down before the right eye, or base up before the left eye, until there is no movement.

As the patient sees the object move down, as the screen moves from the right eye to the left eye, there is a right parallax, and the prism which corrects the right hyperphoria should correct the right parallax.

#### PARADOXIC OR PERVERSE SCREEN AND PARALLAX

A paradoxical or perverse screen and

parallax test means that while the examiner observes an homonymous or esotropic movement of the visual axes, the patient sees the object move as in a heteronymous or exotropic movement. If diplopia is present, the false image is the opposite to what it should be when considering the position of the visual axes.

This is often seen in postoperative cases either for esotropia or exotropia, and usually indicates an anomalous retinal correspondence or faulty projection.

*15 Park Avenue.*

### PHENOMENA ASSOCIATED WITH ECCENTRIC FIXATION\*

#### A CASE REPORT

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In presenting this case report of eccentric fixation 11 points merit consideration. These will be grouped under three headings; namely, Motor phenomena, Visual phenomena, Proprioceptive phenomena.

J. K., a white boy aged eight years, was first seen at the Children's Memorial Hospital when eight months old, because of a right esotropia which had been noticed one month previously.

His birth was normal, but was followed by asphyxia, so that he was kept in an incubator for six days and received an injection of maternal blood.

#### OPHTHALMIC EXAMINATIONS

Examinations when he was one year old—on August 26, 1935, and on October 25, 1935—disclosed an alternating esotropia of 25 degrees associated with a defect in abduction (pseudoparalysis) of each eye. The retinoscopic examination while the eyes were influenced by atropine

cycloplegia revealed an ametropia of: R.E. +7.25D. sph.  $\approx$  +0.25D. cyl. ax. 75° and L.E. +7.00D. sph.  $\approx$  +0.75D. cyl. ax. 120°. The lenses prescribed were R.E. +5.75D. sph. and L.E. +5.75D. sph.  $\approx$  +0.50D. cyl. ax. 120°. At this time the range of the abduction of the eyes began to improve under the influence of cycloplegia. The alternating esotropia became a right esotropia of 20 degrees with lenses and 30 degrees without lenses. The left eye was occluded four to six hours each day and one drop of atropine 0.25 percent was placed in the left eye once each day for one month. This treatment did not improve the right esotropia so that the squint remained, but varied from 30 to 50 degrees for one additional year. Fixation in the right eye was of oscillatory type. The eye was kept occluded constantly for an additional three weeks, during which period fixation ability of the right eye began to improve. Consequently the constant occlusion was continued for six weeks more.

\* Presented before the Chicago Ophthalmologic Society, November 15, 1943.

At the age of  $2\frac{1}{2}$  years the patient was observed to be fixating with the right eye, whereas the left eye was converging 35 degrees without glasses and 20 degrees with lenses. Good abduction in each eye existed but left fixation was thought to be defective. Dr. Gamble, however, reported (on May 14, 1937), "I believe fixation is good in each eye. There is no limitation of abduction. I believe this was originally an alternating squint of pseudoparalytic type which has since become monocular."

Occlusion and atropinization of the right eye did not change the left esotropia. Changes in the glasses did not vary the left esotropia, even though a static retinoscopy revealed R.E. +8.50D. sph. and L.E. +8.00D. sph.  $\approx$  +1.00D. cyl. ax.  $73^\circ$ . New lenses of R.E. +7.25D. sph. and L.E. +6.75D. sph.  $\approx$  +1.00D. cyl. ax.  $75^\circ$  were ordered and received September 8, 1937, when the patient was three years of age. At this time the left esotropia varied from 40 to 50 degrees without glasses and 15 to 45 degrees with glasses.

Additional constant occlusion of the right eye did not improve the vision of the left eye (which was 20/100—1. The right visual acuity was 20/100. The vision in the right eye gradually improved to 20/20 while the left eye decreased to 3/200. The patient was then referred to the orthoptic clinic—on June 25, 1941—when he was first examined by the present writer.

At this time the patient was aged seven years. Unaided visual acuity was R.E. 20/20 : 14/14; L.E. 20/50 (?). Corrected visual acuity was R.E. 20/20 : 14/14; L.E. 3/200 : 3/140. There was an eccentric fixation in the left eye which converged 20 to 30 degrees with and without glasses, respectively, and remained fixating in the eccentric position when the fixating right eye was occluded. Additional occlusion and atropinization of the right eye did not influence the eso-

tropia nor the fixation of the left eye. Five fundus examinations revealed no observable pathologic conditions in the optic nerve or macula.

It was decided to investigate the condition of eccentric fixation by means of the following aids: 1. The cover test. 2. The corneal-reflection test. 3. The motility test. 4. Induced diplopia. 5. Field studies. 6. Past-pointing and past-walking tests. 7. Correspondence test. 8. The electroencephalogram.

The techniques of most of these tests and the resulting findings obtained are demonstrated in the illustrations.

### DISCUSSION

The disturbances associated with eccentric fixation in this case may be studied under three groups: 1. Disturbances associated with the motor apparatus. 2. Disturbances associated with the visual apparatus. 3. Disturbances associated with the proprioceptive apparatus.

#### DISTURBANCES ASSOCIATED WITH THE MOTOR APPARATUS

*The deviation.* The left esotropia of 20 arc degrees remained in the convergent position when the right, fixating eye was occluded (fig. 1, A). The esotropia persisted even when glasses of R.E. +7.00D. sph. and L.E. +7.00D. sph. were worn (fig. 1, B). In other words, the patient fixated with an area nasal to the true fovea (a condition often but erroneously called *false macula*). The deviation could not be measured by means of the cover test but only by means of the Hirschberg corneal-reflection test, because there was no movement of the left eye to fixate when the right eye was occluded.

*Weakness in rotation.* There was a slight weakness in the ability of the left external rectus to abduct the left eye outward, so that the temporal edge of the limbus did not touch the external canthus

(fig. 1, C). This condition was verified by the projection and induced diplopia. The induced diplopia caused by the vertical prism increased in the field of the weakened externus (fig. 1, D and E). This weakness was probably caused by an elongation of the left external rectus, pro-

seen in this case was at the rate of 6 per second. There were other waves at the rate of 3 per second.

The total picture obtained from these data was that frequently seen in people who suffer from cryptogenic minor and major convulsions. This boy had no his-



Fig. 1 (Guibor). Phenomena associated with eccentric fixation (motor apparatus). A, left esotropia of 20 degrees without glasses. Eccentric fixation of left eye. Right eye occluded by card. Patient's eye fixating with extramacular area, object directly in front of him. B, left esotropia of 20 degrees with glasses persists when right eye is occluded by card. Patient's left eye fixating with extramacular area, object directly in front of him. C, limited abduction of the left eye—3 mm. of sclera visible temporally to left eye. D, subjective proof of muscle defect—10° base down in front of right eye to produce a vertical (induced) diplopia. No horizontal diplopia in field of left internal rectus muscle. E, subjective proof of motor defect—diplopia is produced by 10° base down, in field of left external rectus, verifies C.

duced by lack of visuo-motor impulses to this muscle—in other words, a slight atrophy of disuse. That this was not a true paralysis of the abducens nerve but a weakness of the muscle itself must be inferred from the history of the case.

*Variations in electroencephalogram.* The electroencephalogram demonstrated generalized increase in the cortical activity. This increased activity was irregular in character. The rhythm most frequently

tory of convulsive attacks at any time. The electroencephalogram, however, does not display any characteristics of known diagnostic importance in this case.

#### DISTURBANCES ASSOCIATED WITH THE VISUAL APPARATUS

*Amblyopia.* When studying the disturbances exhibited by the visual apparatus in this patient with eccentric fixation, five characteristic changes were

found. The first of these was a loss of visual acuity (3/200 at distance and 3/140 at near). This severe type of amblyopia did not improve when the fixating eye was occluded constantly for four months; a fact that suggests that there may have been some atrophy of the neurons in the visual pathway even though this atrophy could not be ascertained by ophthalmoscopic examination.

*Defective central visual field with normal peripheral fields.* This defect in the visual pathway was demonstrated by a

is presented to the right eye only, for 20 seconds (fig. 2, A); and a horizontal light to the left eye for 20 seconds (fig. 2, B). The patient was asked to demonstrate the position of the afterimages as he saw them. With normal correspondence the patient superimposes the lights as a cross. It can be seen in figure 2, C that this patient with eccentric fixation did not see them as a cross but as if a space existed between the two afterimages. The right forefinger represents the vertical afterimage, the left forefinger the horizontal



Fig. 2 (Guibor). Phenomena associated with eccentric fixation (visual apparatus). A, patient fixates with right eye a glowing vertical filament for 20 seconds. B, patient fixates with left eye (eccentric fixation) glowing horizontal filament 20 seconds. C, patient demonstrates with fingers apparent positions of afterimages (anomalous correspondence). Note binocular afterimages shifted toward patient's right.

study of the central and peripheral fields, on the Ferree-Rand perimeter and near-field apparatus. Such a study showed the examiner that the second abnormal finding in the visual apparatus in this case of eccentric fixation consisted of a 5- to 7-degree absolute central scotoma associated with a normal peripheral field.

*Normal projection but abnormal correspondence.* Normal projection had been demonstrated by the induced-diplopia test (fig. 1, C, D). Here the patient had homonymous diplopia which increased as the left eye was rotated into the field of the weakened external rectus muscle.

The final evidence of abnormality in the visual apparatus was anomalous correspondence. In this test a vertical light

afterimage. The position of the two forefingers suggests anomalous correspondence. This fixed type of anomalous correspondence has never improved by any nonsurgical treatment which I have attempted. It may disappear if the eyes are corrected by surgery on the horizontal muscles.

#### DISTURBANCES ASSOCIATED WITH THE PROPRIOCEPTIVE APPARATUS

Disturbances in the proprioceptive links between the extraocular mechanism and the proprioceptive pathways for the arms and legs were noticed by three objective manifestations—head rotation to the right, past pointing, and past walking when using the left eye.



Fig. 3 (Guibor). Phenomena associated with eccentric fixation (proprioceptive apparatus). A, second stage of pointing test. B, proprioceptive disorganization. Fixating with eccentric left eye. First stage of pointing test—patient still points toward the right of the object. He therefore past points to right. This verifies walking test for presence of proprioceptive disturbance. C, normal proprioceptive ability with right eye fixating. Patient walks on line successfully (suppressing left eye). Note rotation of head toward patient's right. D, right eye occluded, fixating with eccentric left eye, patient falls toward the right. E, proprioceptive disorganization in left eye. Patient walks toward right of white line, fixating with eccentric left eye. This verifies pointing test for presence of proprioceptive disturbance.

*Head rotation.* The head rotation toward the right certainly was not produced by diplopia, as the patient had such poor vision in the left eye that diplopia was impossible unless produced by a vertically placed prism. Therefore, the head rotation may be the result of proprioceptive

impulses to the neck muscles from the eye muscles.

*Past pointing.* When pointing toward an object when he used the left eye he invariably failed to localize the object but pointed six inches to the right of the object (fig. 3, A and B).

*Past walking.* Normal walking, when the right eye was used, was disclosed by the fact that the patient could walk normally along a white line on the floor (fig. 3, C). Yet when the fixating right eye was occluded, the patient tended to fall toward the right (fig. 3, D). After regaining his equilibrium he attempted to follow the line but always walked toward his right (fig. 3, E).

### SUMMARY

The phenomena associated with eccentric fixation when studied intensively may be summarized under three headings: 1. Disturbances associated with the motor apparatus. 2. Disturbances associated with the visual apparatus. 3. Disturbances associated with the proprioceptive apparatus.

Disturbances associated with the motor apparatus may be said to be: 1. The eso-

tropia. 2. The limitation of abduction (weakness in the left external rectus muscle). Induced homonymous diplopia which increased in the field of the left external rectus muscle. 3. Abnormal electroencephalogram.

Disturbances associated with the visual apparatus may be outlined as: 1. Amblyopia (3/200: 3/140). 2. A central scotoma. 3. Normal peripheral field. 4. Normal projection. 5. Abnormal correspondence.

Disturbances associated with the proprioceptive apparatus may be said to be illustrated by: 1. Head rotation. 2. Past pointing. 3. Past walking.

Note: Authorities do not agree that a proprioceptive apparatus is present in the extraocular-motor mechanism. Clinical evidence suggests that such a mechanism does exist.

*30 North Michigan Avenue.*

## ✓ "BIASTIGMATISM"\*

EVALUATION AND CRITICISM OF THE REFRACTIVE TECHNIQUE ADVOCATED BY MÁRQUEZ

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Márquez's use of "bicylindric combinations in the exploration of astigmatism" was certainly one of the most interesting attempts to improve on the technique of refraction as it was performed at the beginning of this century. His publications on this subject, scattered over more than 30 years, appeared in Spanish and French, which is probably the reason why they have received but little attention in this country. It was therefore gratifying to have an English publication recently by Márquez himself<sup>1</sup> in which his basic ideas and his technique were given brief exposition.

Since many interested in refined refraction will have their attention called to Márquez's technique by the publication just mentioned, it seemed timely to investigate—and this has not been done heretofore—how this method compared, *in actual clinical practice*, with methods at present more widely used in this country, especially with a technique which we adopted under Dr. Lancaster's leadership during his stay at the Dartmouth Eye Institute.

Since Márquez's theory and procedures are now easily accessible to the American reader, we shall but briefly enumerate the principal points, using his own words as much as possible.

"Corneal" astigmatism, measured with the Javal-Schiötz ophthalmometer, or other similar instruments, often does not

coincide with the "total" astigmatism, either in dioptric value or as regards the inclination of its meridians, since any of the other refringent surfaces may be deformed or not properly centered. Astigmatism can occur at the level of each of these surfaces. "Total" astigmatism is the result of the various possible partial astigmatisms. Theoretically there exists a mono-, bi-, tri-astigmatism or polyastigmatism.

"Biastrigmatism" was singled out by Márquez because only the corneal astigmatism can be measured accurately, whereas astigmatism that is caused by other surfaces can be measured only *as a whole*.

Márquez pointed out correctly that this astigmatism should not be called "crystalline" astigmatism but should rather be referred to as "residual" astigmatism.

Now the combination of two astigmatisms is equivalent to a third astigmatism, consequently it has repeatedly been pointed out by critics of the Márquez procedure—which we shall outline presently—that the simplest and most preferable method is to determine, as is now generally done, this single "resulting" or "total" astigmatism by any of the subjective methods or by retinoscopy. Márquez's thesis, however, is that there are cases "in which it is precisely a matter of skillful clinical tactics not to do this, it being better to correct both astigmatisms successively in order to determine the total astigmatism more accurately."

This, precisely, is the refractive method

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advocated by Márquez. He first measures, and by a proper cylinder in the trial frame, neutralizes the corneal astigmatism and then confronts the patient with an astigmatic dial. After proper fogging (Márquez calls it "myopizing"), if the radii of the dial should appear unequal (as they usually do), it is obvious that a second, a "residual" astigmatism is present. This he then determines by the subjective method of equalizing the spokes of the dial with cylinders in the usual way.

Thus, both the corneal and the residual astigmatism having been determined, Márquez proceeds to compute the resulting spherical error and the "total" or "resulting" astigmatism, which can be done by means of formulas, tables, or graphically.

Márquez, for some time, advocated the actual grinding of bicylindrical lenses, the corneal and the residual astigmatism being thus separately corrected by two cylinders ground on the anterior and posterior lens surfaces, respectively. We shall not discuss this procedure further. It is possible by this method—which Márquez holds to be advantageous—to arrive at sphero-cylindrical corrections of odd values which do not exist in the trial case, say 0.18 or 2.10 diopters. However, it has never been sufficiently proved that finer gradations than one fourths, or at most one eighths of a diopter are of any value in improving visual acuity or relieving symptoms of strain. As a matter of fact, very few patients are able to recognize any difference at all. The reader interested in this point is referred to Crisp's<sup>2</sup> pertinent remarks and a letter by Márquez<sup>3</sup> to the editor of this Journal.

The purpose of the investigation herein reported was, as has been stated, first of all to compare, in a number of cases, the results of the Márquez technique just outlined, with those of the fogging-and-dial

method of Lancaster<sup>4</sup> and Regan.<sup>5</sup> The comparison of the results, especially the analysis of the differences encountered, revealed certain aspects of Márquez's technique not heretofore evaluated and, it seems to us, led to a more intelligent appreciation of its significance.

It seemed advantageous to have such an investigation made by two observers. First one of us (W. T.) determined the refractive error of the patients used in this study. A cycloplegic was not instilled. In his refractive technique Mr. Triller adhered to the procedure described by Lancaster and Regan as to fogging and other techniques. He then, however, usually checked the cylinder finally arrived at, both as to amount and axis, with the Jackson cross cylinder  $+0.25D.$  cyl.  $\approx -0.25D.$  cyl. or, in sensitive patients also with  $+0.12D.$  cyl.  $\approx -0.12D.$  cyl.

After determining a patient's refractive error, Mr. Triller measured the corneal astigmatism on the Zeiss keratometer and then turned the patient over to the senior author (A. L.), notifying the latter only of his findings on the keratometer. A. L. then determined the patient's refractive error according to the procedure recommended by Márquez, without knowing Mr. Triller's results beforehand.

Contrary to Márquez's suggestion, A. L. always used minus cylinders to neutralize the corneal astigmatism, regardless of whether the patient was myopic or hyperopic, and added minus or plus spheres, as the case necessitated, until proper fogging was obtained. Since, under proper fogging, any "residual" astigmatism naturally had to be corrected with minus cylinders, the exclusive use of minus cylinders for both purposes made the final computations simpler.

From the corneal astigmatism as measured on the keratometer and the residual astigmatism as determined on the astigmatic dial, we computed the patient's "to-

TABLE I\*  
DATA ON 34 PATIENTS TESTED FOR BIASTIGMATISM

(1) No.	(2) Corneal Astigmatism	(3) Residual Astigmatism	(4) Resulting Astigmatism	(5) Dial Astigmatism
1	-5.50 x 4* -5.25 x 10	-1.00 x 175 -1.25 x 20	-6.40 x 2½ -6.38 x 12	-6.50 x 2½ -6.50 x 12½
2	— .50 x 180 — .50 x 170	— .62 x 77½ — .75 x 72½	— .27 x 53 — .30 x 60	— .25 x 70 — .25 x 70
3	-2.00 x 2 -2.25 x 180	— .50 x 40 — .25 x 180	-2.17 x 8 -2.50 x 180	-2.00 x 15 -2.50 x 180
4	-2.25 x 175 -1.50 x 170	— .75 x 20 — .50 x 60	-1.64 x 2 -1.16 x 178	-1.50 x 180 — .87 x 180
5	-3.75 x 20 -3.75 x 165	-1.75 x 60 -1.50 x 130	-4.48 x 32 -4.56 x 156	-4.50 x 35 -4.50 x 162½
6	— .75 x 25 — .50 x 155	-1.37 x 105 -1.00 x 65	— .72 x 95 — .50 x 65	— .50 x 90 — .50 x 90
7	— .37 x 180 — .25 x 45	— .50 x 65 — .87 x 90	— .38 x 41½ — .91 x 82	— .37 x 50 — .75 x 85
8	-1.00 x 98 — .50 x 100	— .75 x 90 — .87 x 82	-1.73 x 95 -1.32 x 88	-1.87 x 102½ -1.37 x 85
9	— -1.00 x 170	— .50 x 100 — .75 x 80	— .50 x 100 — .25 x 470	— .50 x 100 — .25 x 160
10	-1.00 x 150 -1.75 x 180	-1.25 x 47½ -1.25 x 97½	— .54 x 23 — .62 x 165	— .25 x 10 — .50 x 160
11	-1.50 x 10 -1.75 x 170	-1.25 x 95 — .62 x 90	— .37 x 29 -1.18 x 165	— .25 x 10 — .75 x 175
12	— .25 x 90 — .50 x 90	— .25 x 60 — .12 x 130	— .43 x 75 — .54 x 97	— .37 x 75 — .50 x 95
13	— — .62 x 165	— .50 x 90 — .62 x 85	— .50 x 90 — .22 x 125	— .50 x 90 — .25 x 125
14	-2.00 x 12 -2.50 x 160	— .37 x 45 — .62 x 162	-2.16 x 16½ -3.10 x 160½	-2.25 x 17½ -2.50 x 162½
15	-1.25 x 5 -1.50 x 10	— .87 x 10 — .75 x 42	-2.13 x 7 -1.95 x 20	-2.00 x 7½ -1.12 x 175
16	— .62 x 20 — .87 x 170	— .37 x 50 — .50 x 70	— .87 x 31 — .45 x 1	— .75 x 45 — .25 x 140
17	— .25 x 165 — .25 x 180	— .25 x 115 — .25 x 157½	— .32 x 140 — .46 x 169	— .37 x 120 — .25 x 170
18	-1.37 x 155 -1.50 x 10	— .75 x 67½ — .50 x 105	— .60 x 152 -1.00 x 8	— .75 x 150 -1.00 x 10
19	— .50 x 10 — .50 x 140	— .87 x 80 — .25 x 60	— .59 x 64 — .28 x 131	— .50 x 55 — .50 x 120
20	-1.75 x 180 -2.25 x 180	— .50 x 70 — .25 x 180	-1.40 x 7 -2.50 x 180	— .75 x 10 -2.00 x 2½
21	-1.50 x 140 — .50 x 30	— .37 x 50 -1.12 x 80	-1.12 x 140 -1.13 x 67½	-1.00 x 140 -1.25 x 62½

TABLE 1—Continued

(1) No.	(2) Corneal Astigmatism	(3) Residual Astigmatism	(4) Resulting Astigmatism	(5) Dial Astigmatism
22	— .75 x 170 — 1.00 x 175	— .75 x 92½ — .50 x 57½	— .33 x 132½ — .82 x 10	— .12 x 120 — .62 x 170
23	— 1.50 x 180 — 1.25 x 170	— .75 x 85 — .62 x 100	— .76 x 5 — .87 x 157	— .50 x 100 — .50 x 135
24	— 2.75 x 170 — 2.25 x 180	— .25 x 80	— 2.75 x 170 — 2.03 x 1	— 2.75 x 170 — 1.75 x 5
25	— 1.87 x 170 — 1.25 x 180	— .12 x 80 — .25 x 80	— 1.75 x 170 — 1.02 x 2½	— 1.75 x 175 — .75 x 10
26	— .75 x 170 — .50 x 180	— .37 x 55 — .50 x 105	— .57 x 4½ — .25 x 145	— .37 x 180 — .37 x 140
27	— .50 x 160 — 2.00 x 170	— .50 x 65 — .87 x 82½	— .09 x 22 — 1.11 x 166½	— .25 x 40 — 1.00 x 165
28	— 1.37 x 180 — 1.00 x 170	— .37 x 110 — .50 x 75	— 1.11 x 174 — .52 x 175	— 1.00 x 180 — .75 x 180
29	— 1.00 x 170 — .50 x 160	— .25 x 40 — .37 x 60	— 1.01 x 179 — .20 x 180	— 1.00 x 180 — .25 x 150
30	— 2.75 x 165 — .50 x 165	— .37 x 140 — .25 x 25	— 2.96 x 162½ — .60 x 2½	— 3.00 x 162½ — .50 x 180
31	— 1.50 x 70 — .25 x 115	— 1.25 x 112½ — .25 x 90	— 2.02 x 89 — .45 x 102½	— 2.50 x 92½ — .37 x 105
32	— 1.50 x 10 — 2.25 x 10	— 1.25 x 102½ — 1.25 x 107½	— .29 x 178½ — 1.10 x 1½	— .50 x 175 — 1.00 x 2½
33	— 1.00 x 95 — .25 x 165	— .25 x 50 — .25 x 150	— 1.03 x 88 — .49 x 157½	— 1.00 x 85 — .75 x 165
34	— .25 x 180	— .50 x 45 — .25 x 120	— .50 x 45 — .25 x 150	— .50 x 45 — .25 x 140

"Corneal astigmatism" (column 2) indicates the astigmatism found with the keratometer (given in this table in the form of the neutralizing minus cylinder actually used in the trial frame).

"Residual astigmatism" (column 3) indicates the astigmatism found subjectively with the astigmatic dial after the corneal astigmatism had been neutralized.

"Resulting astigmatism" (column 4) is the total astigmatism arrived at by computation from the above values.

"Dial astigmatism" (column 5) is the total astigmatism arrived at subjectively by using the Lancaster-Regan dial.

Since the fogging technique has been used throughout this investigation, only minus cylinders were used regardless of whether the actual patient was myopic or hyperopic. The spherical values of the refractive corrections are not given in the table.

\* In this, as in other columns, the data in the first line are from the right eye, those in the second line from the left eye.

tal" or "residual" astigmatism. The use of a graph published by the Bureau of Visual Science of the American Optical Company, in a pamphlet entitled "Transposition of obliquely crossed cylinders" was found to be most convenient for this purpose. Transpositions with this graph

can be made easily, quickly, and with the amount of accuracy necessary for clinical purposes.

We refrained from any statistical analysis of the small group tested and prefer to publish, in the form of a table, the 34 cases examined in the described manner

(table 1). In this table, the spherical values of the refractive corrections are not given since it would merely have added to the volume of figures without in any way clarifying the problem.

Column 2 of table 1 gives the corneal astigmatism as determined by Mr. Triller.\* We see no advantage in using the designation advocated by Márquez and all the findings are given in the form of the minus cylinders which were used in the trial frame at the time the residual astigmatism was determined, regardless of whether the patient was myopic or hyperopic.

In column 3 is given the "residual" astigmatism; that is, the minus cylinder that was found to be necessary in order that the properly "fogged" patient might equalize the lines of the dial after the corneal astigmatism had been neutralized.

Column 4 shows the "resulting" astigmatism which was computed from columns 2 and 3—that is, *the final astigmatic correction one arrives at when using the Márquez technique*—while column 5 gives the astigmatism as found by Mr. Triller in the same cases with his usual technique. As this astigmatism was determined by using the Lancaster and Regan dial, it is designated as "dial" astigmatism in the table.

If column 2 (the corneal astigmatism) is compared with column 4 (the resulting astigmatism as determined by the Márquez technique), it will certainly be seen that they differ considerably in a number of cases. The same is true if column 2 is compared with column 5. This is to be expected, since Jackson,<sup>6</sup> in his classical paper, showed that neither the amount nor the axis of the corneal and of the total astigmatism correspond in more than about one fourth of the cases.

The main purpose of this paper is now revealed in the comparison of columns 4 and 5 of table 1; that is, in the comparison of the astigmatism arrived at by the Márquez method with the astigmatism found in the same cases by using the fogging-and-dial technique advocated by Lancaster and Regan. If these two columns are compared, it must be admitted that there is a considerable number of cases in which the agreement is really remarkable, the more remarkable in view of the fact that the examinations were made by two different individuals and on an unselected group of patients who have never (at least most of them) been tested with an astigmatic dial before. (An analysis of the differences between the two findings will be given later.)

Convinced, as we are, of the superb accuracy of the Lancaster-Regan technique, any other refractive technique that compares favorably with this standard seems to us to deserve the greatest attention.

It is beyond question—and this comparison confirms it again—that the Márquez procedure has been a definite step forward in refractive technique from those older but still widely used procedures which it was meant to supplant and which based refractive correction on the corneal astigmatism, using, at most, Javal's rules of thumb to improve on it. Only when viewed against this background can the significance of Márquez's achievement be appreciated and if by "ordinary methods" he means these methods, Márquez certainly is justified in stating that he and his followers get "much more exact results—to the great benefit of their patients."

Nevertheless, further analysis of the Márquez technique in general, and of our data in particular, will reveal that as a method for routine examinations for the practitioner it cannot be classed with

\* In this, as in the other columns, the data in the first line are from the right eye, those in the second line from the left eye.

either of the two subjective methods of refraction now prevailing in this country; namely, the fogging-and-dial, or the cross-cylinder technique.

First, to repeat one of Crisp's objections, the Márquez technique is cumbersome and unnecessarily complicated. It requires a longer time than the just-mentioned methods and a greater number of steps. It is first necessary to determine the corneal astigmatism. Then this must be followed by the subjective test on the astigmatic dial with careful fogging for any new amount of hyperopia that may have been artificially introduced, in case a minus cylinder was used to neutralize the corneal astigmatism. In addition, there is the computation of all three components: the cylinder, the sphere, and the axis of the final correction.

Of course, if, as Márquez still seems to believe, all these additional steps do provide an additional accuracy of refractive correction which could not be obtained by any other method, the Márquez procedure would still have to be regarded as the procedure of choice.

Hence the real question which must be answered in connection with the Márquez technique is: *Does this procedure provide any such accuracy as cannot be arrived at by other quicker and more convenient ones, especially by the fogging-and-dial or the cross-cylinder methods?*

To this end we shall have to analyze the individual steps involved in the Márquez procedure.

Both instruments used in connection with the Márquez technique, the keratometer and the dial, naturally are instruments of limited accuracy. In Márquez's own examples the corneal astigmatism is recorded up to the nearest quarter diopter and the nearest 5 degrees of axis, indicating that he neglects an error of  $\pm 0.12D$ . and of  $\pm 2.5$  degrees, respec-

tively. Even the best astigmatic dials, like those of Lancaster and Regan or of Friedenwald, have lines for every 10 degrees only. It is possible, if the astigmatism is not too small, to estimate its axis to the nearest 5 (in good observers 2.5) degrees. One thus takes into account a possible error of  $\pm 2.5$  ( $\pm 1.25$ ) degrees. There is a further limitation of accuracy in the lenses of the trial case, especially on the European Continent, where fractions of one-eighth diopter are uncommon. Most patients with good visual acuity and not too high an astigmatism can differentiate on the dial between fourths of a diopter and many between eighths, if any such are in the trial case, leaving a margin of error of  $\pm 0.12D$ . or  $\pm 0.6D$ ., respectively.

How, then, do unavoidable errors, due to the limited accuracy of the actual measurements, influence the computed results?

The first of these possible errors, obviously, may occur in the axis and the amount of the keratometer reading. Márquez apparently holds accurate keratometer readings to be of the greatest importance, his whole procedure being built around this value. An analysis of the actual procedure, however, will lead to quite different conclusions regarding this point.

The most convenient way of treating the optics involved in the correction of an astigmatic eye—as one of us (A. L.) has emphasized recently in another paper<sup>7</sup>—is to assume the presence of a cylinder of certain power and axis in the eye. The correction of the astigmatism then consists in finding that "glass"-cylinder of *opposite* sign which neutralizes the "eye"-cylinder; that is, the cylinder thought to be present in the eye.

The Márquez procedure can be analyzed most easily in the same manner. One assumes that there are two cylinders present in the eye (one representing the

corneal astigmatism, the other the residual astigmatism). Márquez's procedure will then consist in successively finding the two cylinders of opposite sign necessary to neutralize them. As we have used minus cylinders throughout our investigation and have always dealt with fogged (in Márquez's language "myopized") eyes, we shall choose the "eye" cylinders to be positive and the correcting cylinders negative.

As an arbitrary example let us take the following case: "Eye" cylinders:  $+2.00D.$  ax.  $0^\circ$  (corneal astigmatism)  $\rightleftharpoons +2.00D.$  ax.  $60^\circ$  (residual astigmatism).

The proper biastigmatic correction arrived at in successive steps in the Márquez procedure will be:  $-2.00D.$  cyl. ax.  $0^\circ \rightleftharpoons -2.00D.$  cyl. ax.  $60^\circ$  which, after computation (and neglecting the spherical element) will give for the total astigmatism:  $-2.00D.$  cyl. ax.  $30^\circ$ .

Now let us assume that an error as to axis of the corneal astigmatism of, say, 10 degrees had been made. (This is beyond that error which, in ordinary practice, would be expected to occur and is here chosen only to strengthen the argument.) Obviously the cylinder  $-2.00D.$  ax.  $10^\circ$  which is supposed to neutralize the corneal astigmatism, will not do so fully. From the combination:  $+2.00D.$  cyl. ax.  $0^\circ$  (the "real" corneal astigmatism) and  $-2.00D.$  cyl. ax.  $10^\circ$  (the wrongly placed neutralizing cylinder a "residual corneal" astigmatism of  $+0.70D.$  ax.  $140^\circ$  will result. (The spherical component, which can be taken care of by proper fogging, is again neglected.)

Now the patient so corrected will be seated in front of the astigmatic dial, where he should indicate, by the subjective method, the value of his "residual" astigmatism. We supposed this to be (see above)  $+2.00D.$  ax.  $60^\circ$ , so that in case the corneal astigmatism had been fully

corrected the examination on the astigmatic dial should result in  $-2.00D.$  cyl. ax.  $60^\circ$ . As, however, according to our previous assumption, there was an uncorrected residue of corneal astigmatism, the patient's "actual" residual astigmatism will be  $+0.70D.$  ax.  $140^\circ \rightleftharpoons +2.00D.$  ax.  $60^\circ$ , which equals  $+1.40D.$  ax.  $65^\circ$ , and the correction for this "actual" residual astigmatism, revealed by the astigmatic dial subjectively, will (theoretically) be  $-1.40D.$  cyl. ax.  $65^\circ$ .

According to the Márquez procedure the patient's total astigmatism will now be computed from the two cylinders used. The first cylinder is  $-2.00D.$  ax.  $10^\circ$  (according to the astigmatism which was read erroneously from the keratometer); the second cylinder is  $-1.40D.$  ax.  $65^\circ$  (according to the "actual" residual astigmatism found on the astigmatic dial). The total correction found by computation from these two values will, nevertheless, be right; namely,  $-2.00D.$  cyl. ax.  $30^\circ$ .

We may go even further and postulate that not only the axis but also the amount of the corneal astigmatism was determined erroneously on the keratometer. To make our argument more valid we shall assume an error of  $0.5D.$ , which is much more than the one allowed for in clinical measurements. Both axis and amount of the corneal astigmatism being determined erroneously, the "glass" cylinder in the trial frame to neutralize it will be, say,  $-1.50D.$  ax.  $170^\circ$ .

Having assumed the "real" corneal astigmatism to be  $+2.00D.$  ax.  $0^\circ$ , the "residual corneal" astigmatism, due to improper neutralization, will be  $+0.78D.$  ax.  $20^\circ$ . Assuming further, as we did, that the patient's "real" residual astigmatism is  $+2.00D.$  ax.  $60^\circ$ , on the astigmatic dial he will actually reveal an astigmatism different from this; namely, an astigmatism

that is the resultant of  $+ .78D. \text{ ax. } 20^\circ \rightleftharpoons +2.00D. \text{ ax. } 60^\circ$ , equaling  $+2.26D. \text{ ax. } 50^\circ$ .

Obviously the correction found for this "actual" residual astigmatism on the astigmatic dial will (theoretically) be  $-2.26D. \text{ cyl. ax. } 50^\circ$ , and the total astigmatism, according to the Márquez procedure, will be arrived at by computation from  $-1.50D. \text{ cyl. ax. } 170^\circ \rightleftharpoons -2.26D. \text{ cyl. ax. } 50^\circ$ , which again equals  $-2.00D. \text{ cyl. ax. } 30^\circ$ .

These computations have thus shown that no matter how erroneous may be the reading on the keratometer and the subsequently applied cylinder for neutralizing the corneal astigmatism, the astigmatic dial (*at least in theory*), will always reveal an "actual" residual astigmatism which, together with the erroneously determined corneal astigmatism, by computation, will give the patient's total astigmatism.

Summarizing this section of our discussion we may say that *the determination of the corneal astigmatism on the keratometer and its subsequent neutralization in the procedure according to Márquez, adds nothing to the accuracy of the determination of the patient's total astigmatism.* In other words, the Márquez procedure is as accurate as the astigmatic dial permits it to be, and if one arrives at satisfactory results with it at all this is due only to the use of the astigmatic dial, whereas preceding measurements on the keratometer have no part in them.

This we have also verified in patients. In a number of cases one of us (A. L.) has purposely turned the cylinder out of the proper axis, or applied, in the trial frame, a cylinder altogether different from that which would neutralize the patient's corneal astigmatism. Naturally, the "actual" residual astigmatism in every such experiment was different from the patient's "real" residual astigmatism.

Nevertheless, the finally computed astigmatic correction (within limits of error inherent in such a procedure) remained the same.

In table 2 data from a few cases are given as an example. In these cases the "corneal astigmatism" was "neutralized" with a number of arbitrarily chosen cylinders, as can be seen from column 4. In column 5 the "actual" residual astigmatism, in column 6 the computed total astigmatism are given, while column 7 shows the astigmatism determined by Mr. Triller with the Lancaster-Regan dial.

An analysis of these data now reveals that though there is a close and definite resemblance between the data of columns 6 and 7, they still are not identical. As we have just seen, however, that the keratometer readings (the data in column 3 or 4) have no bearings upon the final result, the discrepancies can be blamed only on the limited accuracy of the astigmatic dial or on the limitations in available fractions of cylindrical lenses.

How, then—and this is our next problem—will this margin of error influence the computed final astigmatism?

In the paper quoted previously, one of us (A. L.) has shown how, by the laws of obliquely crossed cylinders, small errors in the axis of the correcting cylinder, in case its amount is correct or nearly correct, can produce a new astigmatism, small in absolute amount but with a characteristically large difference between its axis and that of the original astigmatism. Obviously the same laws govern the position of the axis of the resultant cylinder in the Márquez procedure, and one will have to expect large errors in the position of the axis of the total astigmatism in a certain group of cases which will be discussed presently. Curiously enough, Márquez repeatedly cited this very group of cases as that for which he asserts the



TABLE 2  
DATA ON BIASTIGMATISM OBTAINED WHEN USING AN ARBITRARY CYLINDER

(1) No.	(2) Eye	(3) Corneal Astigmatism	(4) Arbitrary Cylinder in Trial Frame	(5) Residual Astigmatism	(6) Resulting Astigmatism	(7) Dial Astigmatism
10	R	$-1.00 \times 150$		(a) $-1.25 \times 47\frac{1}{2}$	$-.54 \times 23$	$-.25 \times 10$
				(b) $-1.00 \times 50$	$-.34 \times 10$	
				(c) $-.87 \times 50$	$-.37 \times 180$	
			$-1.00 \times 180$	$-.62 \times 90$	$-.37 \times 180$	
			$-1.00 \times 120$	$-1.12 \times 20$	$-.38 \times 170$	
	L	$-1.75 \times 180$		(a) $-1.25 \times 97\frac{1}{2}$	$-.65 \times 165$	$-.50 \times 160$
				(b) $-1.25 \times 100$	$-.72 \times 162$	
				(c) $-1.37 \times 100$	$-.66 \times 157\frac{1}{2}$	
			$-1.75 \times 150$	$-1.37 \times 52\frac{1}{2}$	$-.58 \times 170$	
			$-1.00 \times 45$	$-1.25 \times 142\frac{1}{2}$	$-.40 \times 163$	
24	R	$-2.75 \times 170$			$-2.75 \times 170$	$-2.75 \times 170$
			$-2.75 \times 20$	$-2.25 \times 150$	$-3.25 \times 178$	
			$-2.75 \times 180$	$-.75 \times 140$	$-3.00 \times 172\frac{1}{2}$	
	L	$-2.25 \times 180$		$-.25 \times 80$	$-2.03 \times 1$	$-1.75 \times 5$
			$-2.25 \times 150$	$-2.25 \times 30$	$-2.25 \times 180$	
32	R	$-1.50 \times 10$		$-1.25 \times 102\frac{1}{2}$	$-.29 \times 178\frac{1}{2}$	$-.50 \times 175$
			$-1.50 \times 170$	$-1.00 \times 75$	$-.56 \times 179$	
	L	$-2.25 \times 10$		$-1.25 \times 107\frac{1}{2}$	$-1.10 \times 1\frac{1}{2}$	$-1.00 \times 2\frac{1}{2}$
			$-2.25 \times 160$	$-1.50 \times 55$	$-1.20 \times 179$	
			$-1.50 \times 160$	$-1.00 \times 50$	$-.98 \times 1$	

"Corneal astigmatism" (column 3) designates the astigmatism found with the keratometer (given in this table in the form of the neutralizing minus cylinder actually used in the trial frame).

"Arbitrary cylinder in trial frame" (column 4) designates a cylinder arbitrarily chosen in lieu of the one that would have actually neutralized corneal astigmatism.

"Residual astigmatism" (column 5) designates the astigmatism found subjectively with the astigmatic dial after a minus cylinder, as designated in Column 3 or 4 had been put into the trial frame.

"Resulting astigmatism" (column 6) is the total astigmatism arrived at by computation from the above values.

"Dial astigmatism" (column 7) is the total astigmatism arrived at subjectively by using the Lancaster-Regan dial.

The patient in case 10 has been tested on three different occasions, after neutralization of corneal astigmatism, and gave three slightly different values for "residual astigmatism" as indicated by (a), (b), and (c), which, of course, changed the value of the "resulting astigmatism."

advantage of his technique to be especially obvious.

It is the group of cases in which the corneal astigmatism is well-nigh neutralized by a residual astigmatism of nearly equal amount but opposite axis. The total astigmatism in such cases, obviously, is of small amount. Márquez's contention that this small astigmatism may be masked, so to speak, by astigmatic ac-

commodation, we shall not now discuss as being beside the point in this connection.

As an example, we may consider a case in which the corneal astigmatism is  $-1.00D.$  ax.  $0^\circ$  and the residual astigmatism, say,  $-1.25D.$  ax.  $90^\circ$ . The resulting astigmatism will then be  $-.25D.$  ax.  $90^\circ$ . With the corneal astigmatism neutralized, we shall expect this patient to designate

the horizontal lines on the astigmatic dial as the blackest ones, indicating that the axis of his residual astigmatism is in the vertical.

Suppose, now, that the patient makes an error in his judgment of 5 degrees on the astigmatic dial (which, as has been discussed, is well within the limit of possible errors, especially for relatively small amounts of astigmatism), designating  $85^\circ$  as the axis of his residual astigmatism, the computation will give  $-.33D$ . ax.  $69^\circ$  (instead of  $-.25D$ . ax.  $90^\circ$ ) as the value for his total astigmatism. Now suppose further, that in addition the patient makes the minor error (also well within the limitations of the method), of judging the amount of his residual astigmatism as  $-1.12D$ . (instead of  $-1.25D$ .), the total astigmatism as computed will be  $-.23D$ . ax.  $58\frac{1}{2}^\circ$ .

One can readily see the comparatively large differences, especially in axes, between these values. As such small errors as have been assumed are, however, within the limits of accuracy of the astigmatic dial and are therefore inevitable, it is impossible to decide by the Márquez technique which of the values is right. On the other hand, if one were to use the Lancaster-Regan technique in the same case, he would in most cases pick up the existence of a small astigmatism with axis somewhere in the vertical with no greater error than 10 degrees at most, on either side of the proper value; namely,  $-.25D$ . cyl. ax.  $90^\circ$ . In other words, there are at least certain cases in which the astigmatic dial loses accuracy when used in connection with Márquez's technique. The computation which must follow its use magnifies instead of telescoping, as Márquez thought, possible errors.

Our cases in table 1 show that this argument has not merely a theoretical value. Cases no. 2, 9 (left eye), 10 (right eye), 11 (right eye), 13 (left eye), 16

(left eye), 22 (right eye), 27 (right eye), 29 (left eye), 32 (right eye) belong to this group. Their corneal and residual astigmatism is nearly equal and the difference between their axes is around  $90^\circ$ . When comparing columns 4 and 5 one will readily see that the agreement between the two is poorest in these cases. Case 10 (see table 2) is of special interest in this connection, as we had an opportunity to recheck this patient twice after we became aware of the special problem involved in this type of case. One can see from table 2 that, with the same cylinder to neutralize her corneal astigmatism in the trial frame, this patient (on three different occasions) gave three slightly different readings on the astigmatic dial, all three well within the limits of possible error. Still, the computation of the total astigmatism according to Márquez's procedure furnishes three considerably different values (cf. lines (a), (b), and (c) in columns 5 and 6 of table 2).

In summarizing this section of our analysis, we may state that we thus have a certain group of eyes for which the Márquez technique is definitely unsuited. If, on the other hand, there is a majority of cases in which the Márquez technique gives excellent results, this only means, in the light of our analysis, that there is a majority of cases in which it lives up to the possibilities and the accuracy of the astigmatic dial. Our analysis, however, makes it clear that for intrinsic reasons the *accuracy of the Márquez technique* (being entirely dependent on the accuracy of the astigmatic dial, findings of the keratometer have no bearing on it) *can never be greater than that of the dial technique*.

#### SUMMARY

1. The astigmatic error of an unselected group of 34 patients was determined with bicylindric combinations, as

recommended by Márquez in his numerous studies on "biastigmatism," and the results compared with those of the fogging-and-dial technique developed by Lancaster and Regan.

2. Analysis of the Márquez technique revealed that accuracy of measurements of the corneal astigmatism and its preliminary correction are irrelevant for the ultimately computed astigmatism, since any uncorrected corneal astigmatism is taken up by the residual astigmatism and revealed subjectively by the astigmatic dial.

3. The accuracy of the Márquez procedure is thus totally dependent on the accuracy of the astigmatic-dial technique and its limitations, whereas neutralization of the corneal astigmatism, as recommended by Márquez, adds nothing to it.

4. While the results of the Márquez procedure, in a majority of cases, compare favorably with those of the fogging-and-dial technique, there is a certain group of cases in which its accuracy is decidedly inferior.

5. The Márquez procedure is unquestionably superior to those older techniques which based the astigmatic correction chiefly on keratometer readings.

6. Since the Márquez procedure, even at its best, cannot furnish more accurate results than the direct use of the astigmatic dial, there is nothing that would recommend the adoption of this complicated technique for routine refractive examinations.

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# THE ENDOCRINE TREATMENT OF KERATOCONJUNCTIVITIS SICCA\*

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Keratoconjunctivitis sicca, or Sjögren's disease, known for some years, used to be attributed to diminished lacrimation. The frequent association of deficient lacrimation and salivation with systemic manifestations, however, soon aroused a suspicion that the disease was not a purely local condition. A significant relationship with disorders of the endocrine system, especially a connection with ovarian deficiency, was mentioned by Fuchs. A survey of more recently observed material (Sjögren, Bruce, and Gifford *et al.*) bears out the earlier observation that most of the patients are of menopausal age (Isakowitz, Hauer), although the onset of their symptoms may have preceded the climacteric by many years (Lisch). The disease, at any rate, seems to be definitely sex linked, for it occurs with few exceptions only in the female. Gifford *et al.* recently reported 12 typical cases, 2 of which were in males whereas the 10 others were in women. An incomplete picture of the syndrome was observed in 21 other patients; this group included 5 males whereas the women in both groups were elderly, with the exception of 3 of childbearing age.

Symptoms which point to a systemic nature of the disease include dryness of the mucous membranes of the oral cavity, nasopharynx, sinuses, and larynx. Dryness and scaling of the skin were also observed. Arthritis affecting the extremities was mentioned by Sjögren in 17 of 22 cases; it was noted in one half of the material reported by Bruce.

Recent reviews (Bruce, Gifford *et al.*) have dealt in detail with the pathology, clinical symptomatology, and differential diagnosis of the disease. Referring in all these matters to these papers, our report is meant to discuss merely some therapeutic aspects of the disease in connection with a single case of keratoconjunctivitis sicca which was treated first in the orthodox ophthalmologic manner by one of us (J. J. F.); subsequently, in view of varied menopausal manifestations, the patient was studied and treated as an endocrine problem.

## CASE HISTORY

Mrs. E. S., 55 years of age, was first seen on November 9, 1940. Soreness of both eyes dated back to 1938; her condition, diagnosed earlier as keratitis, did not respond to any of the previously instituted treatments. She complained of a sensation of burning, comparable to the presence of a foreign body in the conjunctival sac. She was incapacitated for her work as a dressmaker. She also noted dryness in the nose, mouth, and throat. A luetic infection, acquired in 1930, had been energetically treated; Wassermann tests consistently negative since 1936, yet bismuth-salvarsan therapy had been administered every six months.

On examination, a high-grade, hypermetropic refraction (7 diopters) was found; visual acuity was 20/40; additional correction permitted reading of the smallest print (Jaeger 1) at 10 inches. A scanty mucous discharge exuded from the conjunctival sac in the form of long filaments. A dry velvety appearance replaced the usual glossy surface of the conjunctiva. The lower part of the cor-

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nea appeared to be irregular and lacking in its usual brightness. Epithelial shreds were pendant from the surface of foci of infiltration which were scattered all over the cornea. The conjunctival sac contained considerable threadlike debris.

A filter paper\* left in touch with the conjunctiva for 40 seconds remained dry; this is in contrast to the normal eye which thoroughly wets filter paper up to a distance of 10 to 12 mm. within 40 seconds. Slitlamp examination after application of fluorescein to the eye showed faint staining of the lower part of the cornea as well as of the bulbar and palpebral conjunctiva; numerous small foci of infiltration on the surface of the cornea and a few faceted pits in the corneal epithelium were also noticed. The sensitivity of the cornea was well maintained. Except for pericorneal injection, the eyes appeared normal in all other respects.

The findings enumerated justified the diagnosis of keratoconjunctivitis sicca. Therapeutic measures instituted included: (1) Administration of vitamin A, orally and locally; (2) instillation of potassium iodide; (3) instillation of Locke's solution; (4) repeated irradiation of the tear glands with minimal stimulating doses of X rays.

As all these procedures were ineffectual, it was decided to close the lacrimal canaliculi by cauterization. The improvement obtained, however, was only temporary, for the ocular symptoms soon recurred in full severity in spite of the obliteration of tear drainage. As the dryness in the mouth, throat, and skin increased and became associated with lack of perspiration during the hottest summer weather as well as with an irritating vaginal itch, an endocrine study of the patient seemed desirable.

The patient, a short ( $61\frac{3}{4}$  inches tall)

woman, weighed  $163\frac{1}{2}$  pounds (May 31, 1941). Except for some growth of hair on chin and cheeks, no physical abnormalities were found. Menstrual periods once normal had begun to diminish gradually seven years ago. An ovarian tumor (inflammatory?) had been removed 30 years previously. Vaginal examination revealed no abnormality except a slight discharge and redness of the labia. Vaginal smears showed the typical menopausal picture. Basal-metabolism rate  $-10$ ; specific dynamic action of proteins considerably increased (26). Other laboratory findings included: a relative lymphocytosis of 40 percent and elevated values of glucose (119 mg. percent), uric acid (4.7 mg. percent), and cholesterol (261 mg. percent) in the blood.

Estrogenic therapy was instituted for the control of the vaginal itch, the general prurigo, and the dryness of the nasopharynx, without any definite expectation that this treatment might have an effect also on the condition of the eyes. The treatment consisted of oral administration of stilbestrol beginning with one milligram daily and injections of Progynon B (Schering), 4,000 R. U. twice weekly. The dosage of stilbestrol was gradually raised to 4 mg. daily until, at the end of the second week, the patient appeared to be relieved of the vaginal itch and general prurigo. No improvement of the eyes was noticeable at that time. The treatment was continued with decreasing dosage for three more weeks; finally, stilbestrol was replaced by estrone sulphate (Premarin), 2.5 mg. thrice daily, and the injection of Progynon B decreased to 4,000 R. U. weekly. Within less than two months after treatment was begun (August 1, 1941), the patient reported considerable improvement of her eyes. Subsequent reduction of estrogen intake was followed by a relapse, hence (September 12, 1941)

\* Nitrazine paper strip, E. R. Squibb & Sons, New York.

stilbestrol was prescribed again, 2 mg. daily. Excellent response was noted within three weeks and confirmed by an ophthalmologic checkup. Subsequently, the patient was kept in good condition and able to work by continued stilbestrol therapy of varying dosage. Ophthalmologic examination on January 10, 1942, showed absence of all changes in the right eye and only insignificant residual changes in the left.

The patient was maintained, thereafter, on a daily dose of 0.5 mg. stilbestrol until June, 1942, when the vaginal itch recurred and simultaneously, also, the eye condition became worse. In spite of the immediate increase of the dosage of stilbestrol to 3 mg. daily, improvement was not nearly so satisfactory as previously upon the use of comparable quantities. Under these conditions, a therapeutic test with progesterone seemed indicated. Upon administration of 2 mg. progesterone, injected three times a week, definite improvement was soon noticed and complete regression of the condition was obtained after two weeks of this treatment. Thereafter patient remained well controlled on 1 mg. stilbestrol daily until January, 1943, when another mild relapse occurred which did not yield promptly to increased dosage of stilbestrol. Administration of progesterone again was strikingly effective just as on the first occasion.

Following continued stilbestrol maintenance the eye findings were again checked on September 10, 1943. At that time, lacrimation of the right eye was almost normal whereas that of the left eye was still defective. One small superficial epithelial lesion on the left cornea was visible with the slitlamp, whereas the right eye was normal to all appearances. These findings were corroborated by Dr. E. Torok who saw the patient in consultation on October 11, 1943. Dr. Torok

had seen the patient previously (1939), at which time the condition was "approximately the same in both eyes."

Following another course of progesterone injection, combined with 3 mg. stilbestrol daily, further improvement of the left eye was obtained with the result that the patient's condition at the present time appears to be normal. Together with the changes of the conjunctiva and cornea, the dryness of the nasopharynx, the scaling and itching of the skin, and the pruritus of the vagina are well controlled.

### DISCUSSION

It is not permissible to draw far-reaching conclusions from therapeutic results obtained in a single case. Yet our observations are so striking and so well in accord with the endocrine background of this ophthalmologic disease, that a report of our findings seems justified.

It is well known that lack of ovarian hormones causes changes of the uterine and vaginal epithelium and also leads to atrophy of the epidermis (Goldzieher). In other cases, local foci of hyperkeratosis or scaling develop on the skin (keroderma, Haxthausen), a condition which is attracting increasing attention. These changes yield satisfactorily to therapy with estrogens (Lynch), especially upon topical application. Similar claims have been made also in respect to the nasal mucosa, the atrophy of which was noted in hypogonad or menopausal cases (Mortimer *et al.*). Primary atrophy of the nasal mucosa with its onset before the age of 20 years improved in 86 percent of the cases; in secondary atrophic rhinitis, with its onset after the age of 20 years estrogenic therapy produced improvement in all cases so treated (Blaisdell). It is reasonable, therefore, to assume that a lack of sex hormones also induces atrophic or regressive changes on the epithelial lining of other mucous

membranes, not only on the vaginal and nasal epithelium or on the epidermis of the skin.

The systemic character of Sjögren's disease and its essentially sex-linked nature points in the direction of an ovarian hormonal factor. Their impression is strengthened by the preponderance of women at the climacteric age among patients affected with this disease. The incidence of keratoconjunctivitis sicca in women of childbearing age and, particularly, the few cases observed in males have discouraged serious investigation of the specific hormonal background. Previous attempts to treat patients with "estrogenic extract" (Gifford *et al.*) were apparently but half-hearted and too inadequate to be successful.

The incidence of the disease in women of childbearing age, at any rate, is no evidence against the pathogenetic significance of sex-hormone deficiency, for ovarian failure is not uncommonly met with in young women and expressed by more or less marked abnormalities of the menstrual cycle which may not necessarily come to the attention of the ophthalmologist. Nor does the rare incidence of the syndrome in males discredit the view that a deficiency of sex hormones is operative. Males and females produce

estrogens as well as androgens, and deficiencies of hormone output are just as likely to occur in the male as in the female. It would be desirable to ascertain whether male patients afflicted with Sjögren's disease reveal clinical evidence of eunuchoidism or other signs of gonadal disorders. Assays of the urinary hormone output might contribute additional information. Even more desirable would be the therapeutic test, either with the male or female sex hormone in order to confirm or disprove its curative effect on male patients.

#### SUMMARY

A case of keratoconjunctivitis sicca, observed over a period of three years is reported. Treatment with the standard ophthalmologic methods was unsuccessful. Remarkable improvement, practically amounting to a cure, was obtained by administration of estrogens. A relapse not controlled by increased dosage of estrogen yielded to added treatment with progesterone.

These observations confirm the belief that deficiency of sex hormones plays an important role in the pathogenesis of Sjögren's disease.

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## SEEING DEFECTS IN NONREADERS

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After 20 years of observing the way children behave, I believe that psychologic tests can be used to supplement the very simple routine eye tests that are used, because of limited funds, in most cities, for screening out the children who need examinations by specialists; moreover, if the eye charts are used as if they were educational tests, and if the child's behavior during the testing is interpreted in the same way as a psychologic examination, the reason why so many children do not learn to read, or learn only slowly, emerges clear and convincing.

The puzzle why backward children do learn to read when brighter ones do not, resolves itself, at least in part, when we find that the nonreaders do not see well enough to identify the printed symbols on the page. As a psychologist and teacher, I can merely report poor vision as a behavior response that I can appreciate and prove as such. Why the child does not see, whether the defect is physical, to be corrected by glasses or other medical means, whether the fault is irremediable, or to be changed by teaching because the measurable eye is "normal," is for the ophthalmologist to determine.

The conditions that I have found cannot be corrected by the means available to school teachers or psychologists. The defects that exist have not, so far, been reached by the teaching which has been successful with those who have learned to read. When medical science has had its say, then teaching methods can, perhaps, be devised for those few children who, according to the best medical opinion, should be able to see and yet do not.

At present all reading methods for sighted persons seem to assume that the would-be learner sees adequately.

This report is not concerned with reading as the adult knows it, but with the elementary or beginning step; that is, the translation of the visual symbols into the thoughts which these symbols stand for and which the beginner already knows. No modern teacher attempts to teach any pupil to read what he cannot understand. Nor does the modern method fail to limit the quantities of reading matter to the apparent intelligence of the child.

Since this study covering 15 years was begun as a reading survey (with the aim of finding out, if possible, why these children did not learn to read), and since not all of the 2,500 received all of the tests which I eventually used, statistics cannot cover in all details the situation for each and every child. In the early years only such tests were given as seemed necessary to find out how to teach these children to read. Even toward the end the tests were never primarily measures of vision. I merely tried to find out whether or not the child could see clearly the material presented. This was true also when I made use of the simple eye charts with which every one is familiar.

The school medical reports for eyes in my city seem to be much like those of most large cities, my 2,500 nonreaders had been tested with the Snellen charts, the report being as usual a fraction indicating the visual acuity of each eye tested separately but never with both uncovered. In some cities this extra step is sometimes made so that there is some record as to how the child's two-eyed seeing compares with the conventional one-eye-at-a-time tests. Children with serious

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eye defects requiring instruction in sight-saving classes had with very few exceptions already been examined by the school ophthalmologist and therefore did not turn up among our nonreaders.

This unbelievably generous gentleman—busy though he was—gave so freely of his own time that many children whose parents refused to take them for eye examination were properly examined. These after wearing glasses learned so much better that it seemed well worth the effort to push on with the investigation, especially since some of the children who already had glasses were still nonreaders.

The material is vast but not all has been tabulated. So far, however, it points to the hope that with greater assistance from eye specialists there will be fewer nonreaders among adults than there are now, since teachers may be able to trust their own observations about their nonreaders before they have wasted long years of futile teaching and discouraging failure.

Through these school routine examinations the doctors had already found the nearsighted, although only 8 percent of the whole number of nonreaders were wearing glasses at the time of the psychologic examination. The school nurses were doing their best with the rest who apparently needed glasses. It is astonishing how antagonistic some parents are to all thought of glasses, and how long it takes even well-to-do parents to provide for eye examinations.

On the school medical cards 55 percent of the nonreaders were reported as having vision less than 15/15, but of course 15/20 would not necessarily indicate nearsightedness. In nonreaders the blur which gave less than 15/15 vision was in some cases shown to be not nearsightedness, but some other defect. Twenty percent of the nonreaders were marked on the medical card as having less than 15/30 vision

for one or for both eyes, but during the depression glasses were too often not obtainable for children with eye defects less serious than 15/50 in both eyes.\*

A nearsighted person who wears glasses knows that near objects appear larger to his eyes without his corrective glasses. Hence it would be likely that simple nearsightedness would usually not be a handicap for reading. It was possible to have 150 nonreaders whose eyes seemed equally nearsighted examined by an ophthalmologist, and in all of these cases it was reported back that other defects existed: "eyes on different planes," "astigmatism," "oblique eyes," "muscular atrophy" (quoted from the reports returned). Some of the defects were considered too small to require glasses, and some were labeled "mental defect," which I interpreted to mean some impairment in control which could not be measured, since all of these 150 had a Binet I.Q. above 90. (This I.Q. was given with not one lenient interpretation of the answers.)

Of 1,062 nonreaders in one group, 659 showed differences between the two eyes as against 159 on the school records with different fractional ratings for each eye, but only 65 of the 659 wore glasses, leaving 283 whose visual impressions must have departed from the normal.

In some cases these children whose eyes were different used one eye for distance and the other for nearer points. Sometimes the change over confused the images the child got, especially for print. Sometimes the struggle was quite clear

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\* Reports do not always make clear why glasses are ordered. Of 500 cases in 3 schools followed up for 2 years, 80 percent were given glasses immediately, 15 percent were asked to return later, 5 percent were supposed not to be "eye cases." These 500 cases were marked 15/15 on the medical card. "Muscular atrophy" (4.22) was reported on 3 of 25 cards returned on these 500 cases.

to even a not-so-professional observer.

Although we as teachers learn in school that at six years emmetropic children are able to accommodate to near vision, it was decidedly not so with some of these 2,500 nonreaders. The 15/15 vision of the medical record proved to represent not normal vision but farsightedness for which the routine examination made no provision and which the teacher was not taught to expect: during her school days she was not taught to differentiate between presbyopia and farsightedness; to her, farsightedness was a disease of old age. Teachers are not systematically taught, of course, about eyes.

Of the 1,587 children tested for seeing beyond 15 feet, 96 were too farsighted to see print in a book, and 286 more could not see ordinary print at 14 inches but could do so at from 3 to 10 feet. With the conventional charts the child could see the 15-foot line at 20, 30, 40, and in several cases at 60 feet. That is, large numbers of nonreaders were not yet adapted to reading easily at the normal distance or were, perhaps, never going to be.

To judge from the child's behavior, the greatest single difficulty for nonreaders seemed to be the failure to fuse properly the two images. We are told in school that fusion or proper coördination of "convergent eye movements is regulated by the unconscious desire for binocular vision"; however, unless the child has in some way learned that normal vision is not the blur he sees, it might very well be that he does not feel this desire for binocular (therefore, clearer) vision, inasmuch as one might conceivably not be able to strive for something of which one was completely unaware.

Among 1,062 (out of 2,500) nonreaders, 68 squint cases were reported at the routine examination. Could it be that only these 68 had made an adequate effort to eliminate one of the images? In certain

tests 261 made no effort to converge, although no strabismus was discovered, rather did their eyes seem to remain, as it were, in parallel; 151 let one eye turn outward, more or less, as an object approached to 14 inches, although no squint was evident for ordinary distance. The rest of these children confused designs, shapes, figures, in such a way and so often as to give clear proof that they still saw two images, overlapped, or doubled images.

Including these 1,062, I tested 1,572 first as on the routine test one eye at a time, then with both eyes uncovered as one normally functions. Only 160 could see as well at 15 feet with both eyes as with each one alone; 153 could see with the two eyes as well as with the dominant eye if the vision in the two eyes tested alone was somewhat different but not seriously so.

In 545 cases wherein the eyes seemed to alternate badly, I tried to teach the child to converge properly, first by using a pencil; then by having him compare smaller designs with large ones that he could reproduce. Among these, 383 were unable, within the time allowed, to make any change. The rest varied in their effort, although they obviously knew what they were trying to do. These children systematically doubled and reversed in tests using numbers and letters (copied bird as brid, for instance.)

The psychologist has, of her own efforts, no way of knowing whether irregular convergent movements or poor control of the eye movements has been interfered with by cerebral lesions which we are told do lead to impairment of vision. The spasmodic activity seen in these nonreaders could not be analyzed; there was little time for history finding, and if parents were consulted they did not know of anything that might explain conditions. Paralysis of ocular or oculomotor nerves

was reported in several cases, history of diphtheria, and other serious illnesses; but since, in such cases, medical help was needed parents were told to seek the help of specialists. Mostly no reports came back.

One thing was clear: These children had not learned to see one image clearly, and would not be able to learn to do so merely with the help of a teacher who has 30 or 40 children to teach unless medical attention would make the eye behavior better. Routine eye examinations show very frequently changes in the record over a period of years so that a presumably normal pair of eyes may a year later show abnormal behavior. For example, the same doctor (not a specialist) in 1942 gets for the same child O.U. 15/15 vision, but in 1944, O.U. 15/30 or L.E. 15/30, R.E. 15/50; in 1939, O.U. 15/15, but in 1944, R.E. 15/70, L.E. 15/30, or a continued up-and-down history never explained and perhaps never corrected, probably because the parents think the child has good eyes or do not "believe in glasses." The psychologist's tests sometimes in the same week showed wide variations as if something (digestive upset, perhaps?) might temporarily have blurred the seeing. There was, of course, as a rule, no proof, since physicians can hardly be expected to render either a verbal or a written report these days, even in a worthy cause.

No psychologist would be willing to say that glasses will necessarily provide all the conditions needed for teaching non-readers of this type. The cause is often obscure, apparently also sometimes to the medical observer; therefore the cure must sometimes be sought by trial and error even by the eye specialist who finds the correctible defect too small to seem to count, and by the teachers whose usually successful methods have no effect upon a child's learning.

Since teachers have no way of knowing, by their own tests, how far they may go in forcing a child to try to see, it would seem wiser for them not to develop "techniques" to force better use of the eyes by their pupils. Teachers can know that the child does not see clearly, but they cannot know whether or not the non-reader's vision is poor.

We cannot say that for the nonreader the teaching is poor until we know what the eye specialist thinks about the eyes. Nor can we assume that because the defect is not usually a hindrance that it is *not* one and perhaps the real cause of failure to learn. Neither teacher nor parent nor any one else should accept unquestioningly 15/15 for vision on a test chart as adequate proof that a nonreader has good vision.

We teachers and the school psychologist need the ophthalmologist—and badly.

*Low Buildings.*

# NOTES, CASES, INSTRUMENTS

## THE THERAPEUTIC USE OF CHOLINE IN OPHTHAL- MOLOGY\*

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Although choline is a chemical of remarkable potency which has been basically studied (the research begun nearly a century ago, and complete reports have been made regarding it), nevertheless it had been almost completely disregarded as a therapeutic agent of merit for the treatment of certain ocular diseases in man to the time when this investigation was started some two years ago.

This contribution is not concerned with choline's therapeutic value in other organs than the eye and its appendages; however, it is submitted as a lead for others who may find choline therapeutically an arresting research problem.

Regarding its effect upon the lower animals, the biochemist, the biophysicist, and the biophysicologist have written volumes as to what happens when it is adopted experimentally. Its performance in their hands has been dramatic, and they describe what it accomplishes with arresting words.

Georgy<sup>1</sup> regards this agent's action as that of a vitamin. Lucas and Best<sup>2</sup> said that "choline should take its place with the other members of the B-complex, from which it cannot now legitimately be separated in any complete consideration of metabolic changes." It is also classed as a hormone by Mitchell.<sup>3</sup> Best and Ridout<sup>4</sup> consider choline to perform as a "lipotropic agent" and that choline, from the physical point of view, is a wetting agent. Besides, the molecule is both non-

polar and polar according to Swan and White.<sup>5</sup>

Best and Lucas<sup>6</sup> "account for the voluminous literature on choline as due to the relationship of the substance to the ubiquitous phospholipids," yet with all the information at hand there are but few comments as to its use for man.

My initial experience with choline I credit to Dr. H. H. Beard, professor of biochemistry, Louisiana State University School of Medicine, who provided me with a well-grounded lead for the treatment of a lipoidosis and had me administer methionine to a young man who suffered from Spielmeier-Vogt disease (juvenile amaurotic idiocy), a disease in which, according to Duke-Elder,<sup>7</sup> there exists a faulty lipid metabolism, and for which treatment has been ineffective.

This amino acid, methionine, was discovered by Tucker and Eckstein<sup>8</sup> and found by them to possess lipotropic potency. Du Vigneaud et al.<sup>9</sup> offered the suggestion that methionine exerts its lipotropic action by contributing its methyl group for the synthesis of choline, a transmethylation reaction that they proved to occur. With this information at hand I adopted choline.

In this particular lipoidosis, that of the amaurotic idiot, the pathognomic vacuolated "foam" cells, accompanied by a lipid degeneration, characterize the changes brought about in the central nervous system and the ganglion cells of the retina.

Both agents, namely methionine and choline, almost immediately accomplished the lowering of an extremely high temperature and a continuous epileptic spell that accompanied the disease, which otherwise was uncontrolled. I concluded therefore that choline and choline's pre-

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cursors were of benefit for at least certain occurrences in the abiotrophies of Sorsby.<sup>10</sup>

I carried out my investigation further so as to note choline's potency in the treatment of other diseases, and, as a consequence, adopted choline for the treatment of xanthoma planum, supposedly a purely cholesterol infiltration of the skin. The yellow blotches faded in approximately four to five weeks after the ingestion of choline, 5 grains three times daily. Sterner<sup>11</sup> had suggested that choline would hasten reabsorption of these plaques. This it did under my observation. Best and Ridout<sup>4</sup> had shown "that the feeding of choline prevented the deposition of neutral fat and to a lesser extent that of the cholesterol esters in the livers of animals receiving pure cholesterol in their diet." It thus appears that choline was involved in the metabolism of cholesterol as well as that of the lipoids.

My therapeutic investigation of choline was continued to discover whether it would influence an exophthalmos. The patient's proptosed eye had not receded after a goiter operation; however, when choline was used it did recede, and again the effect was credited to a lipotropic action.

Case 4 was that of a young woman, 21 years of age, who developed a tuberculous retinal perivascularitis following a biopsy for a lupus of the face. The tubercles disappeared within a few weeks and the multiple retinal hemorrhages, concurrent with the disease, were arrested and became absorbed. In another case, a tuberculous retinochoroiditis with a large nodule was not benefited by choline. It was at this time that I began to study the action of choline on the leper. Such work, however, has been very limited and incomplete and one hesitates to make any

statement regarding it.

The need of choline in cases of certain pathologic changes has been established in the rat by others. Lower animals that suffer a choline avitaminosis develop fatty kidneys and kidney hemorrhages. Both conditions subside on the administration of choline. Perlman, Rubens, and Chaikoff<sup>12</sup> state that "choline had an anti-hemorrhagic effect and this was seen in tissues other than the kidneys."

The tuberculous child in this report, as also the tuberculous woman, gained weight and the child's growth apparently was accelerated. Weight increase and body growth are characteristic therapeutic effects of choline. MacLeod,<sup>13</sup> while studying insulin, also observed this remarkable nutritive factor of choline.

Then, for the time being, I digressed to consider choline's effect when instilled into the conjunctival cul-de-sac, when injected subconjunctivally, and when applied in the pure state to corneal ulcers and vascular loops, and again in every conceivable type of tissue pathology where I suspected lipoids and cholesterol crystals might be present in consequence of previous disease conditions or traumas. We have produced mustard-gas lesions of the eye in rabbits, the pathology of which is familiar through the writings of Mann and Pullinger.<sup>14</sup> It was natural to try to remove the fats and cholesterol. Choline accomplished this feat.

It was discovered that choline, 5 gr. to the ounce of water, could be used to irrigate the conjunctival cul-de-sacs and without the slightest irritation. It acted as one would wish a perfect pH to do and it could be adopted indefinitely for such a purpose.

I observed that choline was a wetting agent and that dry cicatricial pemphigus mucous membrane could be moistened and that choline had an effect upon the

pathologic change. From the demonstration upon the dry tissue of pemphigus and the effect upon the pathologic change I began to argue that choline may be an enzyme. Strack<sup>15</sup> and his collaborators showed "that certain lesions, notably liver and placenta, possess enzymes which liberate choline rapidly from phospholipids." I knew by laboratory tests that choline had some antiseptic value and would bleach tissues, remove scabs, and when rubbed on the face had vanishing qualities. As a dentifrice it had no peer.

Choline when applied pure at the end of a match stick to a moderate-size ulcer of the cornea proves to be a strong detergent, for when so applied the base of the ulcer comes to present a limpid appearance.

The greatest of my surprises came when I observed that choline would affect the diseased eyelashes of trichiasis, and that epilation was found to be unnecessary. Naturally, I concluded that the pathology of trichiasis was a diseased root in which fats and cholesterol were factors to be removed before the lash could grow properly.

Choline is definitely known to be a strong base; its solutions dissolve fibrin, and it does not coagulate the proteins. I have had but a most limited opportunity to give choline a trial in the epidemic form of superficial punctate keratitis. In the limited experience I have had, it appears to be beneficial both locally and as a nutritional factor.

A statistical study will not be presented here as to the effect of choline upon cataract other than to make the statement that it does not affect mature cataract and has very little, if any, effect upon incipient cataract. However little effect it may have, its potency is greater than that of vitamin B<sub>2</sub>.

Choline does have a definite effect upon

the general nutritional condition of many patients suffering from cataracts.

It should be stated that choline's molecule is both polar and nonpolar and when the radical is combined with certain antiseptics greater than itself, they are carried deep into the tissues.

The case of pterygium is not as Duke-Elder would have it, in that "the only treatment is surgical," but pterygium is the result of an avitaminosis in which choline affects the growth no matter how it is administered—internally, when used as an eyewash, or when applied directly to the pterygium's head in crystal form by means of a toothpick. The islets of Fuchs, which are of lipoid and cholesterol bodies, fade. Choline produces a reversal in these fatty bodies.

*In conclusion:* Choline is a therapeutic agent of merit when adopted for the treatment of the eye and its appendages. Unquestionably it is a great dietary factor and is a lipotropic agent. The phospholipids and cholesterol deposits following pathologic changes in the eye are reversed, thereby altering the nutrition of the cell, whether choline is taken internally or applied externally.

It has an effect upon tubercles, leprous, or otherwise. Physically it is both a polar and nonpolar compound, thereby highly soluble in lipoids and in water. Because of these characteristics it has great tissue-penetrating powers, whether alone or in combination with chemicals.

Its effect can be demonstrated dramatically. A crystal of choline dissolves in fats and in water. It can be put into the eye in natural form, instilled in solution, or applied as an ointment without producing pain. Witness the immediate action of a few crystals when placed on the head of a pterygium, the action when injected into a pterygium, and note what happens to the pterygium when choline



is taken orally for a few weeks. Note its effect upon ulcers of the cornea, and on new blood-vessel formation at the limbus. Finally, note that its solution has

a high dielectric constant, containing a charged group.

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## BILATERAL CATARACT EXTRACTION IN ANTERIOR MEGALOPHTHALMOS

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The clinical syndrome recognized as "Adult hereditary anterior megalophthalmos sine glaucoma" has been observed and reported by ophthalmologists for approximately 75 years; successful bilateral cataract extraction in this condition, however, has never been reported; indeed, unilateral cataract removal has encountered frequent complications and successful results have comprised less than 55 percent of the total number of cases cited in the literature in which operation was performed.

The entity now described as anterior hereditary megalophthalmos sine glaucoma is one of exceeding interest, both because of its pathologic characteristics and

its challenge to the ophthalmic surgeon to produce visual improvement for such individuals as possess this rare condition complicated by cataract. The syndrome consists of bilateral enlarged corneas, occurring practically always in males as an hereditary sex-linked characteristic, coupled with deep anterior chambers, iris atrophy and iridodonesis, and absence of all evidence of glaucoma; there may occur embryotoxon or arcus senilis, dislocation of the lens, which may or may not be cataractous, and miosis of the pupil resulting from iris atrophy.

The etiology of anterior hereditary megalophthalmos sine glaucoma is not clear; the subject was adequately reviewed by Vail in 1931, and the literature reveals very little new evidence since that time, although various authors have reported cases, some being, however, examples of megalocornea without the additional characteristics of anterior

megalophthalmos. Some of the causative theories advanced for the condition are:

(1) that it is an anomalous type of buphthalmos; (2) that it is a manifestation of atavism, as in mammals other than man the cornea is much larger in proportion to the size of the entire globe; (3) that it is due to endocrine-gland disturbance, producing overgrowth of the involved tissues; and (4) that it is an inherited form of tissue hyperplasia accompanied by later degenerative changes in the anterior segment of the eyeball. All these ideas are conjectural and have not been proved by complete pathologic findings, but it would seem most probable, in the light of present information, to regard the syndrome as an hereditary phenomenon, sex-linked, producing overgrowth of the anterior covering of the eyeball followed by secondary degenerative changes in the iris and lens.

In a large percentage of these cases cataract occurs, and as the hazards of operation are substantially greater and the results reported not particularly impressive it was deemed to be of interest to record a case in which bilateral cataract extraction was performed followed by rather unusual sequelae and ultimate good vision to the present date of observation. A review of the literature reveals that in approximately one third of the cases of megalophthalmos, cataract occurs, but it should be emphasized again that some observers have not distinguished between megalophthalmos and megalocornea in reports, whereas the conditions constituting anterior megalophthalmos—that is, iris atrophy, iridodonesis, and changes in the lens zonular fibers—all create a much more hazardous situation for cataract extraction than a condition of megalocornea alone. In the available reports of patients who have been operated on, in many instances the type of lens opacity is not definitely stated,

but in those reviewed about 80 percent were either mature or hypermature in degree and nuclear or cortical in type.

All varieties of surgical procedures have been attempted in the technique of delivery of the lens; some surgeons have done no iridectomy while others have performed a preliminary iridectomy; some have utilized sutures, others have not. The cataract has been extracted with a needle, spoon, or following stripping of the capsule with forceps; in 85 percent of cases there was loss of vitreous, and in over 60 percent of cases there ensued postoperative complications such as separation of the retina, glaucoma, iridocyclitis, and persistent opacities in the vitreous. It seems probable that each surgeon utilized the technique most familiar to him and to the era contemporary to him in operating on these patients rather than endeavoring to apply a surgical approach and method more applicable to the pathologic changes to be encountered. Results have not been startling nor remarkably beneficial to the patient. For these reasons when the opportunity presented itself to me to essay cataract extraction in this abnormal condition, several points of caution concerning operation came to mind; first, insertion of three corneoscleral-tract sutures seemed desirable to insure firmer and more secure healing of the wound and less likelihood of iris or vitreous prolapse; second, removal of the lens in capsule was of paramount importance to forestall any complication due to remaining lens remnants; any procedure involving stripping of the capsule was to be avoided, as the literature showed that practically all such surgical procedures ended in disaster; third, insistence upon a slow and gradual convalescence from operation, especially with reference to getting up and around, was necessary, to allay possibilities of retinal separation; fourth, extraordinary preop-

erative conjunctival antisepsis and sedation for the patient seemed highly desirable for production of ideal operating conditions.

With these thoughts in mind bilateral cataract extraction was performed upon a 49-year-old male with anterior megalophthalmos as described below; following each operation there were several weeks in which occurred recurrent hyphema and vitreous hemorrhage notwithstanding all the precautions observed. Eventual complete absorption of the hemorrhage took place, however, with the procurement of clear media and normal fundi. Vision with lenses in each eye equals 20/30, and the patient is delighted and astonished with the result; of course, it is obvious that the postoperative period is relatively short and that unwelcome complications may yet take place, but to the present date of observation such a result following bilateral cataract extraction in anterior megalophthalmos is rare indeed.

#### CASE REPORT

Mr. J. B., aged 49 years, single, a laborer of American parentage, was first seen by me in January of 1941. At that time he stated that his vision had never been good during the entire course of his lifetime. During the previous six months, it had, however, become progressively worse and had recently reached the point where he was unable to carry on his occupation or to read ordinary news print.

He had had no previous eye disease but had worn glasses from childhood. The patient was one of seven children and was the only member of the family who had abnormal eyes or poor vision. He was of average intelligence, had progressed satisfactorily in school, and apparently was alert and mentally normal. There was no history of consanguinity in the family. He stated, however, that his eyes had

always been extraordinarily large but that he had been able to carry on his work, and that his general health had always been excellent.

Examination revealed vision in the right eye to be 6/200. The lids and conjunctiva were normal. The cornea was clear centrally, although there was marked arcus senilis. The cornea was perfectly transparent but appeared similar to a large inverted bowl. The anterior chamber was very deep and the pupil was irregular in shape, approximately 3 mm. in diameter, and reacted sluggishly to light. There was marked atrophy of the iris, with absence of chromatophores and crypts. An extreme degree of iridodonesis was present upon movement of the eyeball. A nearly mature nuclear and cortical cataract was present. There was normal projection of light in all quadrants and tension was 14 mm. Hg with a Souter tonometer. It was impossible to improve the patient's vision with any lens. Measurement of the cornea revealed the horizontal diameter to be  $14\frac{1}{2}$  mm., whereas the vertical diameter measured 14 mm. (figs. 1, 2).

Examination of the left eye revealed vision to be 4/200. The cornea was also bowl-like in appearance, transparent and clear centrally, with an extreme amount of arcus senilis. The anterior chamber was very deep and clear. There was also extreme lack of pigment cells in the iris, with absence of crypts. The pupil reacted to light slightly better than did the right eye, but was also irregular in shape and about 3 mm. in diameter. The amount of iridodonesis was very marked upon movement of the eye, and a nearly mature cataract of nuclear and cortical type was present. There was normal projection of light in all fields, and tension was 12 mm. Hg with the Souter tonometer. Vision was unimproved with any lens; measurement of the cornea showed the horizontal di-

ameter to be 14 mm. whereas the vertical was 13.5 mm.

Examination of the right eye with the slitlamp revealed the central cornea to be clear and transparent. The epithelium

around the mid-stroma to the sphincter margin, with absence of pigment. The nuclear portion of the lens showed some accumulation of brownish pigment on the surface. The results of slitlamp ex-

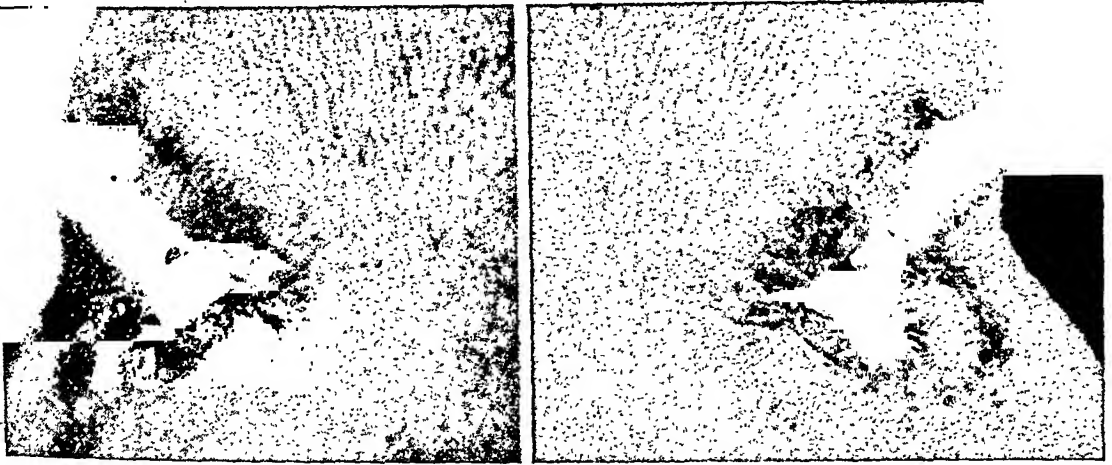


Fig. 1 (Donahue). Anterior megalophthalmos—lateral view.



Fig. 2 (Donahue). Anterior megalophthalmos—anterior-posterior view.

was entirely normal. There were no striations nor folds in Descemet's membrane. The posterior cornea showed no precipitates. The iris stroma showed extreme atrophy with absence of pigment cells and no formation of crypts. The iris blood vessels seemed to be contracted and smaller than normal and there was a moth-eaten, threadbare appearance of the iris

amination of the left eye were essentially those of the right.

In March, following a period of antiseptic treatment to the conjunctival sac, operation was performed by me upon the left eye. Following akinesia by the Van Lint method and retrobulbar injection, three corneoscleral-tract sutures were inserted after the method

of Verhoeff. An incision from the 10:00- to the 2:00-o'clock position was made, following which there was a profuse outflow of aqueous with pronounced collapse of the cornea. The extremely large cornea became inverted and wrinkled and there was a mushy softness of the eyeball with sinking backward of the lens opacity. Enlargement of the section on either side was done with scissors, and it was possible to rethread the tracts rather easily. The atrophic iris was grasped at the 12:00-o'clock position and iridectomy performed. Because of the above-described soft condition of the eye, however, it was difficult to grasp the lens, for visibility was poor owing to the collapsed eyeball and the extreme degree of downward prolapse of the cataract. However, attempts were made to grasp the lens at the equator without success, and fearing that the lens might be further pushed back by additional manipulation, I decided to remove it with the wire scoop. This was easily done, with the loss of a very little fluid vitreous; following this, the sutures were tied and the iris pillars repositioned.

The lens was of normal size, of the cataracta nigra type, and a rather unusual finding was that, attached to the posterior pole was a strand of tenacious, stringy vitreous approximately one-half inch in length. Such an attachment of vitreous to the lens had never occurred before in my experience and it presented quite an extraordinary sight. No complications occurred followed delivery of the lens and the patient was returned to his room in good condition.

For the following five days, convalescence was uneventful but, upon the sixth day, considerable bleeding into the anterior chamber took place, resulting in a 5-mm. hyphema. Upon the next day, the anterior chamber was completely filled with blood and there was no visible red fundus reflex. No change in this con-

dition ensued for the next week, although various antihemorrhagic and anticoagulant forms of therapy were employed together with absolute rest in bed and local treatment to the eye. There was no increase in intraocular pressure at any time. Following a three-week postoperative stay in the hospital during which very little absorption of the anterior-chamber hemorrhage occurred, the patient was discharged to return home, but to report to the office for observation and treatment.

Ten days after hospital discharge, observation in the office showed a great decrease in the amount of blood in the anterior chamber, with concurrent absorption of vitreous hemorrhage so that a red reflex could be obtained upon examination with the ophthalmoscope. Large strands of organized hemorrhages could be seen in the fundus. Two weeks later this blood had become absorbed to a greater degree, and two months following hospital discharge the media were entirely clear, with the exception of a few vitreous opacities. The fundus could easily be seen and showed nothing abnormal, with the exception of scattered degenerative retinal changes due to long-standing myopia.

Fourteen weeks after operation, correction of the patient's operated-on eye with a +1.00D. sphere gave vision of 20/30. This result was extremely gratifying to him, and he was astonished to possess as much vision, never having experienced any comparable amount of sight. He returned to his occupation. Six months later I performed the same type of operation upon his right eye. Oddly enough, the same course of events followed operation on this eye by the use of the same methods as those described for the other eye. Massive hyphema and vitreous hemorrhage which persisted for six to eight weeks following operation gradually cleared up.

Because of the previous experience with intraocular hemorrhage, I had conferred with medical consultants concerning such bleeding and all the current types of antihemorrhage therapy were employed without success. The intraocular blood took approximately eight weeks to become absorbed. The media and fundus showed no pathologic changes 10 weeks after operation, with the exception of myopic retinal changes. A +2D. sphere with a +2.50D. cylinder, axis 165° produced 20/30—3 vision, and the patient was able to read Jaeger 1 print with the addition of a +2.00D. sphere to both lenses.

This man has been seen at intervals during the past 20 months and no untoward complications have occurred. It is

very apparent that the postoperative period has been relatively short; notwithstanding this fact such a result to date is extremely gratifying and beneficial to an individual suffering from anterior megalophthalmos complicated by nearly mature lens opacities, and is uncommon in surgery of the eye.

#### SUMMARY

A case of anterior megalophthalmos in which successful bilateral cataract extraction was performed, is described. A description of the syndrome, itself, as well as some additional data concerning cataract extraction in this condition are presented.

*520 Commonwealth Avenue.*

# SOCIETY PROCEEDINGS

EDITED BY DR. DONALD J. LYLE

## CHICAGO OPHTHALMOLOGICAL SOCIETY

March 15, 1943

DR. LOUIS G. HOFFMAN, *president*

### CLINICAL PROGRAM

(Presented by the Department of Ophthalmology, Cook County Hospital)

#### DEEP CENTRAL CHORIORETINITIS

DR. RALPH SIEGEL said that C. A., a man aged 46 years, was first seen in the Eye Clinic on February 25, 1943, one week after he noticed sudden marked blurring of vision in the right eye, not accompanied by pain.

Corrected vision, R.E., was reduced to 0.2. The disc was normal, but in the macular and paramacular areas there was a gray, dome-shaped elevation measuring about 3.0 P.D., with a sharply defined nasal border starting abruptly, three vessel diameters temporal to the disc. The temporal border of the lesion was not sharp. Superior to the center of the elevation and above the macular area was a 0.5-P.D. patch with pigmentation in the shape of a cross. The left eye was normal in all respects; corrected vision, 1.2.

Peripheral fields of the right eye showed moderate concentric contraction and an irregular central scotoma for isopter 3/330 white. Central fields showed a 12-degree central scotoma for isopter 5/1,000 and an absolute central scotoma for red and blue, 5/1,000.

Blood Wassermann, Mantoux, and chest X-ray study showed negative results. No focus of infection was found on physical examination.

Three days ago the nasal border of the lesion appeared flat, and the retinal

edema subsided. The corrected vision, R.E., is now 0.5.

#### TRAUMATIC COLOBOMA: HUGHES OPERATION

DR. RALPH SIEGEL said that H. L., a man aged 39 years, came to the Eye Clinic on September 6, 1942, with a traumatic coloboma of most of the left upper lid due to a human bite which had occurred a few hours prior to admission.

A moist chamber was used for several days, followed by a Friedenwald suture, which prevented damage to the cornea by exposure. On October 16th, when infection of the wound edges had subsided, a modified Hughes operation and skin graft were performed. A horizontal incision was made below the brow and the skin of the upper lid was undermined. The lower lid was split transversely into two layers, starting along the intermarginal white line and dissecting downward. The upper epithelial border of the lower tarsus was cut off and this was united to the remains of tarsus and the deep portion of what remained of the upper lid. The previously undermined skin of the upper lid was drawn downward and attached to the freshened skin margin of the lower lid by two intermarginal sutures. The remaining defect beneath the brow was filled in with a full-thickness graft taken from the right upper lid.

On November 13th there was some contraction of the skin graft and a Thiersch graft from the thigh was used to fill in the defect below the left brow. A transverse trough was dissected below the intermarginal adhesion line at this time, and a strip of hairs was excised from the left temple and transplanted



in position to form lashes; another lash transplant was performed on January 29th.

The patient now has a fully reconstructed upper lid with a luxuriant growth of lashes, and needs only an opening of the intermarginal adhesions.

#### NEUORETINITIS PAPULOSA

DR. R. H. LEHNER presented B. S., a Negro aged 25 years, who was first seen on January 9, 1943, with a history of having been kicked in the right eye by a horse at the age of 8 years, following which most of the vision in that eye was lost. Six years ago the vision of the other eye began to fail. Vision, R.E., 18/200, with correction 20/100; L.E., 20/200 with or without correction.

In 1937, because of positive serologic findings, he was placed on antisyphilitic therapy, and the blood test is now negative.

In the right eye the lens is dislocated down and inward; a central opacity is present just anterior to the adult nucleus with a fine dustlike opacity surrounding the entire nucleus. There is a fairly recent small area of choroiditis just inferior to the macula. The left disc is slightly pale; there are large areas of chorioretinitis which include the macula; connective tissue extends along the veins, and a connective-tissue strand horizontally below the disc from the macular area to the nasal area of chorioretinitis.

The presence of the connective-tissue strands below the disc, the periphlebitis, the postneuritic atrophy, and the disseminated chorioretinitis point to the diagnosis of neuroretinitis papulosa.

#### CHORIORETINITIS WITH RETINITIC ATROPHY AND CHOROIDAL SCLEROSIS

DR. R. H. LEHNER said that J. T., a man aged 50 years, was first seen on February 11th with a history of blindness in

the right eye for 45 years, and poor vision in the left eye for the past two and a half years. Vision, R.E., 10/200; L.E., 20/200. In spite of vigorous antisyphilitic therapy since 1939, the blood test has remained positive.

The fundus of the right eye shows a pale well-demarcated disc with complete absence of retinal pigment except at the periphery. The fundus is of a pale-yellow color and the choroidal vessels are sclerotic. In the left eye there are dense posterior synechiae, with organized exudate over the anterior lens capsule, partly obscuring the fundus reflex.

#### CYSTIC LESION OF MACULA

DR. JACK E. BROOKS presented R. C., a Negro boy, aged 15 years, whose complaint on admission, on March 4, 1943, was impairment of vision of the left eye for six weeks. Two months preceding blurring of vision he had been struck in the left eye with a fist; photophobia and lacrimation followed.

The corrected vision in the left eye was 0.4. The vitreous was very hazy and contained a clot of blood. The disc margins were blurred and obscured superiorly with superficial hemorrhages over and just superior to the disc. The macular region contained a biconvex elevation, sharply demarcated and clear, through which the choroid and fovea could be seen. Striae were present in the retina on both sides of this area, having a sheen of reflexes as of traction folds. The marked engorgement of the veins had somewhat subsided. Inferior to the disc two horizontal streaks of hemorrhage were seen, apparently preretinal.

All laboratory and X-ray reports were negative; no focus of infection was found.

#### PERSISTENT HYALOID-ARTERY REMNANTS

DR. WILLIAM KUHLMAN presented

A. G., a woman aged 46 years, whose corrected vision when seen on January 6, 1943, was R.E., 1.5; L.E., 5/200, not improved with glasses. She gave a history of having had poor vision in the left eye all her life.

A persistent hyaloid remnant was seen extending from the postero-nasal surface of the lens to the nasal side of the optic disc. The fundus for a distance of 2 to 3 P.D. around the disc was obscured by large masses of black pigment which also cover the macular area. Other areas show choroidal atrophy.

#### POSTERIOR VITREOUS DETACHMENT

DR. WILLIAM KUHLMAN said that M. P., a woman, aged 38 years, had been presented before the Society one year ago. She had been under intermittent observation since December, 1939, during which time little appreciable change in the condition had been observed. Vision at this time is 1.2 in each eye.

In the fundus of the right eye, along the superior temporal vessels there is seen a delicate grayish-white semitranslucent membrane with concavity downward, projecting into the vitreous, curving downward to the nasal aspect of the disc and then along the inferior temporal vessels, where it appears to merge with the retina proper; here it does not appear to be elevated. Above, the membrane covers the vessels and a patch of old chorio-retinitis as a cloud.

#### SCIENTIFIC PROGRAM

##### THE FUNDUS IN HYPERTENSIVE PATIENTS TREATED WITH SYMPATHECTOMY (abstract)

DR. JEROME A. GANS. At the University of Chicago Clinics, 18 patients of all ages and in all stages of essential hypertension were studied medically and ophthalmologically and then subjected to total (or nearly so) thoracolumbar sympathectomy. The 15 survivals were

followed for periods of from 1 to 2¾ years. In studying the material it was impossible to evaluate separately the sclerotic-vessel changes and the acute hypertensive signs, by using existing classifications. A new classification was therefore adopted which allowed separation of the sclerotic from the hypertensive signs, as follows:

#### *Classification of Vascular Disease of the Fundus*

##### $A_0H_0$ —Normal

$A_1$ —Mild arteriolar sclerosis	$H_1$ —Arteriolar constriction
$A_2$ —Severe arteriolar sclerosis	$H_2$ —Hypertensive retinopathy
$A_3$ —Same with focal insufficiency (thrombosis)	$H_3$ —Same with papilledema.

It was found that the degree of sclerosis was not affected by sympathectomy, certain patients showing a slight increase. However, the acute hypertensive signs (spasm, hemorrhage, exudate, edema of the retina, papilledema) showed a marked tendency to disappear. Those patients who had the least organic sclerosis showed the most favorable lowering of blood pressure following sympathectomy, whereas those with the most severe sclerosis were least benefited. The presence of hemorrhage, exudate, and papilledema was of less value prognostically than the degree of sclerosis of the vessels.

*Discussion.* Dr. Roy O. Riser felt that Dr. Gans had summarized the surgical results well; other complete reports are available in medical literature. Almost as many classifications of hypertensive retinopathy have been proposed as there are discussers of the subject, and the beginner becomes quite confused. Dr. Gans mentioned two classifications—the Keith-Wagener and the Gifford-Macpherson. The Keith-Wagener has been given more publicity in application to clinical problems, and seems to find favor with the internist. For the ophthalmolo-

gist, however, the Gifford-Macpherson has definite advantages.

Kodachrome slides taken at the University of Illinois were shown to illustrate the stages of these classifications. There is no stage in either classification for isolating cases with thrombosis of the retinal vein. One picture showed K. W., grade II in one eye and extensive hemorrhages following thrombosis in the other eye. Dr. Wagener has explained this by stating that the thrombosis was a "vascular accident" and that one should evaluate the true prognostic state by examination of the condition of the retinal vessels in the other eye. Should Dr. Gans's class  $A_3$  really influence the prognosis as being worse than  $A_2$ ?

The preoperative and postoperative fundus photographs showed the only definite findings Dr. Riser had seen in the hypertensive fundi as related to sympathectomy: first, the "flushing" of the retina following surgery in the early cases; second, the marked regression of hemorrhages, exudates, edema, and even papilledema of the late stages; and by comparison, the lack of change in the sclerotic retinal vessels, which confirms Dr. Gans's findings so definitely.

Dr. Jerome A. Gans (closing) said that it would be amiss to attempt to classify all thromboses and all vascular accidents as  $A_3$ . It should have been emphasized that this designation includes only those cases with severe vessel disease of grade  $A_2$  having superimposed vessel thromboses. The type of vascular accident found on an embolic basis, or due to localized phlebitis, or causes other than essential hypertension, should not be included in this classification.

#### THE PRESENT LIMITS OF GONIOSCOPY

DR. PETER C. KRONFELD and DR. H. ISABELLE MCGARRY read a paper on this subject which has appeared in this Journal (February, 1944).

*Discussion.* Dr. Thomas D. Allen hoped some day to get the answer to questions he had asked Dr. Wilder: Why there is less aqueous, if glaucoma is a condition of the eye in which the aqueous cannot escape? Why is the anterior chamber not deep? Why does the tension recede when a hole is made in the anterior segment?

It has been said that in deep-chamber glaucoma the condition is due to pigment which interferes with the escape of aqueous—the exit is blocked; that all that is necessary is to make a little cut in the chamber angle and the aqueous is allowed to get into the canal of Schlemm and out of the eye. Sometimes that operation will work and sometimes not. It seems to be a logical way to handle the situation, and is certainly not a difficult procedure provided the operator has first studied the angle with the gonioscope.

Those at the Infirmary are to be congratulated on their opportunity to discuss problems with Dr. Kronfeld. The work being done is in a fair way to solving the problem of glaucoma. As Dr. Kronfeld says, one must not be too dogmatic about these cases, but if contact glasses of different sizes are available, investigation of the iris angle can be made easily. In one recent case, the history was typical. The palpebral fissure was too narrow for a contact glass, so the fornix was filled with salt solution and the chamber angle could then be seen satisfactorily.

One of Dr. Kronfeld's cases recalled a similar case seen in Seidel's clinic in Vienna; narrow-chamber glaucoma with a tension of 25 mm. Hg (Schiötz). The patient was put in the dark room for two hours, but through oversight was not seen for nearly four hours, at which time the tension was around 60 mm. and the pupil was dilated. Without using a miotic, she was left in a bright light and the tension came down to 35 mm. This shows that darkness is part of the problem.

Study of these cases will help considerably; in operative cases that are successful we should try to learn why we succeeded; or if we are not successful we may learn what error was made.

Dr. Peter C. Kronfeld (closing) said that the relationship between the amount of aqueous present in the anterior chamber on the one hand, and the intraocular pressure on the other hand, becomes clearer if one tries to distinguish between preëxistent and existent conditions. If one finds, in an eye with narrow-angle glaucoma, a shallow anterior chamber in the presence of a tonometric reading of 70 mm., one should ask himself: "Was the shallowness of the chamber brought on by the rise of tension or was it a pre-existent condition?" It is almost certain that in most of these cases the shallowness of the chamber was present before the pressure rose to 70 mm. It is usually the condition of the other eye that shows this very clearly; namely, the presence of a shallow chamber with narrow entrance to the angle, in the presence of a normal intraocular pressure.

There is, however, the possibility that the chamber depth may be altered by a rise in pressure. This, for instance, occurs during the hypertensive phase following anterior-chamber puncture in wide-angle glaucoma; the chamber, after having attained its original depth, becomes slightly shallow together with the rise of pressure beyond the original level. By gonioscopy one can occasionally observe a deepening of the anterior chamber associated with the surgical reduction in intraocular pressure. In an eye with wide-angle glaucoma the entire trabeculum but not the ciliary body may be visible before operation when the pressure is above 40 mm. After reduction of the pressure to normal by trephining or iridencleisis, in addition to the trabeculum a certain portion of the anterior surface of the ciliary body may become visible. The simplest

explanation for these variations in chamber depth associated with changes in intraocular pressure is probably this: In order to maintain circulation at a pressure level of 40 mm. the entire intraocular-pressure level in the circulatory system has to be raised 15 or 20 mm. Such a rise in circulatory-pressure level is probably associated with increased blood volume in the entire uvea, which manifests itself as slight shallowing of the anterior chamber.

ROBERT VON DER HEYDT.

## MEMPHIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

March 8, 1943

DR. J. B. BLUE, *presiding*

### VISUAL IMPROVEMENT IN AMBLYOPIA

DR. E. C. ELLETT reported several cases concerning the restoration of vision in amblyopic eyes in adults as the result of enforced use of the defective eye.

The first patient, W. C., aged 41 years, had a convergent squint and amblyopia of the right eye. The vision of the right eye was 4/200. The refractive error was +7.00D. sph. He had been struck in the left eye by a baseball and suffered a rupture of the sclera, with subconjunctival dislocation of the lens. He was under observation for several years and in spite of being compelled to depend on the right eye for several months completely, the vision did not improve.

The second patient, Miss B. M., an elderly woman with an amblyopic and squinting right eye, developed a cataract in her good eye. Despite the enforced use of the poor eye for many months, the vision did not improve. Removal of the cataract from the other eye restored useful vision. Her case was unusual in that she saw far and near with the same

glass. On account of the previous hyperopia, she required +16.00D. sph. for distance, and with this she saw 20/25 and J1. The squint had undergone a spontaneous cure. The right eye was normal except for a refractive error of +5.00D. sph., and the amblyopia. The vision of the right eye was 3/200.

The third patient was Mrs. S., who had been a patient for more than 40 years. Her first complaint was of poor vision. The vision of the left eye was normal with glasses; of the right eye, 20/40. In 1934 she began to develop a cataract in the right eye. The vision remained normal in the left eye but showed very faint lens changes. In 1939, macular degeneration developed in the left eye and the vision could not be improved beyond 6/60. The cataract was removed from the right eye in April, 1939. The vision in this eye was best off-center for a while, and on May 18th vision was 6/9 with glasses. In June, 1941, the left eye developed acute glaucoma, which was thought to be due to the cataract, which had matured. The latter was extracted in June, 1941. The last test in January, 1942, showed that the vision, R.E., was 6/6 and J1 with glasses, L.E. 6/60, eccentric.

The fourth patient was A. K., a man aged 30 years, who was seen in 1928. The vision was R.E., 20/200; L.E., 20/25. The vision of the right eye had always been defective and, with a normal eye-ground, it was considered an amblyopic eye. Beginning in 1931 he had had several attacks of inflammation in the left eye. He was seen again in 1933, and the vision was 6/60 in the left eye due to an attack of choroiditis in the region of the macula. The vision improved in the right amblyopic eye and in January, 1934, it was 6/6 and J1. The left eye recovered after a few months. When last tested in July, 1942, the vision had receded in the right eye to 6/12 and had improved in the left eye to 6/6. The vision in the right eye

remained normal for about four years, but the patient had much trouble with binocular vision and gradually suppressed the image of the right eye, as he was more comfortable when not fusing. The vision in this eye continued to decrease.

#### CONVERGENCE SPASM UNDER HOMATROPINE

DR. E. C. ELLETT reported a case in which a convergent squint appeared when the accommodation was suspended.

The patient was a girl, aged 6½ years, who had an alternating convergent squint for which a double recession had been done in 1935. The result was very good cosmetically, but she had diplopia with a red glass before one eye and about 10 degrees of esophoria. When she was 12 years old she was refracted under homatropine. While the homatropine was in her eyes, the right eye turned in 15 degrees, but was straight when the homatropine passed off. It was thought that the effort to see in spite of the cycloplegia caused an effort of convergence to correspond to the attempted effort of accommodation, and the excess of convergence was all spent in one eye, which squinted. Another explanation was that due to the blurring of vision caused by the cycloplegia, the stimulus to maintain binocular single vision was not present, and the eye turned in, just as an amblyopic eye was prone to do.

#### CHRONIC GLAUCOMA FOLLOWED FOR MANY YEARS

DR. E. C. ELLETT reported two cases in which vision was preserved and tension lowered for 17 and 19 years, respectively, after a trephining operation.

The first case was that of Mrs. B. C., aged 55 years, who was seen in 1926, because of chronic glaucoma in the right eye. The history was indefinite, but she had been told about six weeks previously that the eye was hard, and she had been

given drops to use. The vision, R.E., was 6/7.5, the pupil measured 5 mm. and was fixed, the disc was white and slightly cupped, and the tension was 60 mm. Hg (Schiötz). The patient's mentality was such that a satisfactory field of vision could not be taken. The left eye was normal, the tension 25 mm. Hg (Schiötz). A corneoscleral trephining with complete iridectomy was performed on the right eye on May 4, 1926. The eye healed normally, and in 1934 after several attempts, a visual field was taken which showed marked contraction. She was last seen in March, 1943, 17 years after the operation. The eye was white, there was a good bleb, an even coloboma with free pillars, and slight lens changes. The vision was 6/7.5 and the tension was 22 mm. Hg (Schiötz). The nerve head was still white but only slightly depressed, more like an atrophic than a glaucomatous cup. The left eye was normal.

The second case was observed in a woman who had been under observation since 1919. She gave a history of poor vision in the left eye for the preceding 15 years. The eye was practically blind, the tension was high, and the disc was cupped. A trephining operation was performed to relieve the pain and it succeeded in doing that, although the vision was not improved. The disc of the right eye was definitely cupped, but the tension was not high and the vision was normal. The highest tension recorded was 28 mm. Hg (Schiötz). A trephining with a peripheral iridectomy was done on this eye in January, 1924. In July, 1942, the vision was 6/6 and J1, and the tension was 18 mm. There was a defect in the upper nasal quadrant of the visual field, but this had not changed for many years.

#### TENDON TRANSPLANTATION FOR PARALYTIC ESOTROPIA

DR. PHIL LEWIS presented a 65-year-

old colored man who had been recently operated upon for an old paralytic strabismus.

In 1907, 36 years previously, this man had developed a sixth-nerve paralysis which caused a marked internal squint. As time went on the squint became worse, so that for the past 15 or 20 years only the temporal border of the cornea could be seen. The amount of esotropia measured about 90 degrees. Attempts to rotate the eye outward with forceps and strabismus hook proved impossible due to the contracture of the internal rectus.

About two weeks previously operation was performed under cocaine and novocaine anesthesia. Turning the eye out sufficiently to reach the internal-rectus muscle was very difficult, but was finally accomplished. The muscle was very fibrous and seemed to have lost almost all its elasticity. It was recessed almost 7 mm. Transplantation was done on the lateral halves of the inferior and superior recti to beneath the stump of the externus, which was resected 15 mm.

A kodachrome photograph was presented to show the appearance before operation. For the first week the eye was overcorrected. The cornea showed some diffuse opacities but some vision remained, about 5/200, after over 30 years of nonuse. The eye was becoming slightly crossed again and there was no outward motion.

This patient was presented to show what might be accomplished in even very severe chronic cases of paralytic strabismus. It is obviously much better to operate before contractures occur.

#### BILATERAL MONOCULAR DIPLOPIA WITH AMBLYOPIA

DR. PHIL LEWIS presented a woman, aged 49 years, who was first seen in November, 1942, complaining of poor vision and diplopia. She stated that about 14

years previously she had completely lost her vision, supposedly due to "cotton blindness." This lasted several weeks, but her vision never seemed to recover fully. For the past five or six years double vision had been constant with either eye or both. Headache was frequent, but she had suffered no serious illness in her entire life. She had taken quinine several times but never very much at any one period.

Examination showed that both eyes were normal externally. The media were clear, and the fundus was normal in each eye. Vision could be improved to only 20/100 in the right eye, and 20/200 in the left eye, with +1.00D. sph. before each eye. With the addition of +2.25D. sph. she could read J10. With each eye separately she saw a blurred false image close by the true image of whatever she was looking at. With both eyes open the two clearer images fused and the two blurred images fused so that she still had diplopia rather than polyopia. This was found true in the six cardinal directions of gaze with a red glass and a small light. There was orthophoria for both distance and near. The curvature of the cornea was normal in each eye with the Javal ophthalmometer. Slitlamp study of the cornea and lens in each eye was negative. The visual-field studies were normal. The blind spot of the right eye was practically normal, but that of the left eye was considerably enlarged. The patient's blood and general examination were normal except that she was underweight. She had improved in general health in the past four months by a better diet, yeast, and vitamin capsules. Her eyes remained the same.

This patient was presented with the hope of arriving at an explanation of the condition and possibly some remedy for it.

## SAINT LOUIS OPHTHALMIC SOCIETY

March 26, 1943

DR. CARL BEISBARTH, *president*

### DIAGNOSIS OF MALIGNANT MELANOMA BY BIOPSY

DR. B. Y. ALVIS gave the clinical aspects of a case of an apparently normal serous type of retinal detachment. At the time of the operation a sclerotomy was done, but no subretinal fluid was found. The Graefe knife, used to make the sclerotomy incision, encountered a semi-solid, gelatinous tissue after penetrating the sclera. By inserting a small curette through the opening Dr. Alvis secured a small amount of this gelatinous material which was then smeared on a slide and sent to the laboratory for examination by Dr. T. E. Sanders. With hematoxylin-and-eosin staining the smear showed cells resembling type B spindle cells. From these findings a diagnosis of intraocular tumor was tentatively made, and the eye was enucleated. Microscopic examination of the removed eye revealed a mixed-cell type of malignant melanoma. It was, therefore, recommended that all retinal detachments should have a transcleral type of transillumination to reveal a tumor, if present.

*Discussion.* Dr. Carl Beisbarth asked what the tension was in this case.

Dr. Alvis replied that it was normal.

Dr. Beisbarth then stated that three or four years ago he had had a patient with a small tumor easily observable near the macula. In this case the tension was always a little higher in the eye with the tumor than in the other eye. After enucleation the pathologic diagnosis turned out to be that of malignant melanoma. He then asked Dr. Sanders if there was any evidence that puncturing a tumor, as in the reported case, could cause it to spread locally and wondered of how much



value transillumination was.

Dr. Sanders said that there was a definite chance of the tumor cells being spread through the sclerotomy opening. When this procedure is done it should be done in the operating room so that if necessary the eye can be removed promptly.

Dr. J. H. Bryan asked if the thermophore might not be used on such choroidal tumors and asked Dr. Shahan if he had not tried it.

Dr. Shahan replied that he had used the thermophore on one case of tumor of the iris which had spread posteriorly. A biopsy was taken and a diagnosis of malignant melanoma made and then the thermophore was applied so as to cover the entire area involved. The eye was still functioning after several years, without any sign of recurrence.

Dr. Sanders added that he had seen Dr. Shahan's case and had been unable to find any evidence of tumor. He said that a tumor of the iris is quite different from a choroidal tumor. They seem to behave quite differently. The death rate from a tumor of the iris is much less than that from a choroidal tumor and it is not fair to compare the prognosis of one with that of the other. He then discussed the question of metastasis, stating that the longer the tumor is in an eye the greater the chance that some of the tumor cells will spread. Metastasis is certain to occur at some time. The earlier an enucleation is done the less time there is for metastasis to occur. That is true in general of all the tumors although some types tend to metastasize much earlier than others.

#### MASSIVE BILATERAL PRERETINAL TYPE OF HEMORRHAGE ASSOCIATED WITH SUBARACHNOIDAL HEMORRHAGE OF THE BRAIN WITH A CASE REPORT AND PATHOLOGIC FINDINGS

DR. L. C. DREWS and DR. JEFF MINCKLER presented a paper on this subject which was published in this JOURNAL (January, 1944).

#### CHOROIDEREMIA

DR. R. G. SCOBEE presented a paper on this subject which was published in this JOURNAL (November, 1943).

*Discussion.* Dr. L. C. Drews said that in Hess's article on retinitis pigmentosa in *Kurzes Handbuch der Ophthalmologie*, he makes a definite statement that choroidal disease had nothing to do with retinitis pigmentosa. In spite of that the disease picture has been produced experimentally by cutting the long posterior ciliary nerves. Dr. Drews said that he had been interested in the treatment of retinitis pigmentosa with retinal choroidal pigment. Considerable clinical work has been done on this, with variable results. A rather interesting point was that several authors had reported isolated cases of choroideremia occurring in the same families that had retinitis pigmentosa in other members of the family. Returning to the subject of treatment of retinitis pigmentosa he said that Dr. Luedde had been using retinal choroidal pigment for over 20 years and that apparently in early cases sometimes favorable results were secured. Dr. Drews had seen cases where marked improvement in the visual fields occurred during the course of injections of the retinal choroidal pigment but that these same patients, when treated for six months with injections of different solutions such as saline, typhoid vaccine, milk, and tuberculin, showed no change in the visual fields. He asked Dr. Scobee if there were many cases of well-advanced choroideremia without posterior cataract.

Dr. Scobee said that choroideremia has been considered possibly a primary degeneration of the choroid. In retinitis pigmentosa there is a proliferation of tissue over the surface of the retina. In choroideremia the retina becomes atrophic. As far as the incidence of cataract is concerned in the 36 patients reported only one had a cataract.

James Bryan,  
Editor.

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## CYCLOPLEGICS

The use of cycloplegia for diagnosis of refractive errors is almost universal among physicians who undertake this kind of work. That is to say, nearly all of them use cycloplegia in a goodly proportion of their patients. Some restrict the use of diagnostic cycloplegia to children and young people, up to the age of thirty years. Many make it a rule never to use cycloplegia for this purpose beyond the age of forty or forty-five years, excluding its use in later life for fear of producing glaucoma, although in dealing

with anterior uveal inflammations (as distinct from the "inflammation" of congestive glaucoma) every ophthalmologist would use cycloplegia at any age. It has not been altogether satisfactorily demonstrated that medicinal cycloplegia tends to produce glaucoma in an eye that does not already have the disease, at least in a prodromal stage, but it is a wise precaution to test the tension of middle-aged and senile eyes in which cycloplegia is to be or has been used diagnostically.

The extent to which different ophthalmologists rely upon the refractive meas-

urements obtained under cycloplegia varies greatly. A few never or hardly ever employ cycloplegia in refraction work, regarding it as unnecessary and even misleading. The majority, however, consider it as indispensable, although, strangely enough, many of them measure the refraction under cycloplegia and then throw away much of the advantage thus derived in that they depend largely, for the final prescription, upon a hastily performed postcycloplegic measurement.

Whether therapeutically or as a diagnostic aid in refraction, virtually only three cycloplegics (as contrasted with mydriatics) are available; namely, atropine, hyoscine (also known as hyoscyamine or scopolamine), and homatropine. Therapeutically, atropine is most frequently employed, because with powerful and lasting cycloplegic action it combines a relative freedom from toxic effects. Yet it must sometimes be replaced therapeutically by hyoscine, which is less apt to cause severe and disturbing irritations of skin and conjunctiva. Hyoscine, actually more powerful than atropine in proportion to the concentration of the solution used for instillation, is unfortunately capable of producing in many individuals important nervous reactions, particularly motor incoördination.

The therapeutic effect of homatropine is relatively insignificant, although its frequent instillation in disturbances likely to be of short duration is occasionally helpful, and has the particular advantage of an action which is brief and easily arrested. In the occasional case in which it is proposed to change over from miotics to cycloplegics, the reversal of therapeutic procedure may well be started by keeping the patient in the doctor's office and watching the effect of several instillations of a solution of homatropine. If these act favorably as to pain and do not raise the intraocular pressure, it is

usually safe to change over to a solution of hyoscine or atropine.

The cycloplegic most widely used in refraction work, on the other hand, is homatropine, because with satisfactory brevity it combines a highly useful, although frequently somewhat incomplete, degree of cycloplegia. It is slightly toxic in some patients, although, as the present writer has shown (*American Journal of Ophthalmology*, 1926, volume 9, page 270), this toxicity is practically negligible if the drug is always instilled shortly after a fairly substantial meal. (Where only a single drop of a strong solution of homatropine is used in each eye, a similar protection may be afforded by having the patient take milk and some solid food immediately after this drop is instilled.)

The incompleteness of homatropine cycloplegia is not infrequently a real inconvenience. Oddly enough, more reliable results are occasionally obtained several hours after the use of the drug, and at a time when the cycloplegia is noticeably diminishing, than during the test made when cycloplegia should theoretically be most efficient. The refractive measurement under homatropine is at times so tantalizingly variable and indefinite that it is well to resort to one of the more powerful drugs, hyoscine and atropine, although here, of course, the inconvenience these drugs would cause the patient is a more or less serious obstacle.

It cannot be too often emphasized that the finality of the test under homatropine is greatly enhanced by remembering the possibility of incomplete cycloplegia and applying the unilateral or bilateral maneuvers of the fogging method during the cycloplegic test. Disregard of this practical rule vitiates many cycloplegic and postcycloplegic tests made in connection with the use of homatropine, or even, now and then, of one of the stronger drugs.

Calculations as to the exact interval within which the refraction should be measured after homatropine instillation look well on paper, but must often be imperfectly followed during crowded office or clinic practice. To remedy, in troublesome cases, the incompleteness and fleeting character of homatropine cycloplegia, hyoscine offers a tempting compromise between the inadequacy of the weaker synthetic and the very prolonged action of atropine.

Subject to the rule about a fairly full stomach, most adult patients are sufficiently tolerant to the use in each eye of a single drop of hyoscine hydrobromide, one grain to the ounce. A few are distressingly dizzy after this amount of the drug, although usually they are able to proceed with the test and can go home unaided. A full hour of waiting after the instillation is advisable, and the precision of the cycloplegia obtained is generally excellent.

Because any one of the cycloplegics presents frequent disadvantages, it is natural that attempts should be made to find new cycloplegics or new cycloplegic combinations which give promise of relief from these inconveniences. For the sake of the patient, we should all like to find a drug which would combine the brevity of action of homatropine with the more complete cycloplegia of hyoscine or atropine and which would lack toxic effects.

In view of the many triumphs of pharmacologic research, it seems not impossible that some day such a cycloplegic combination will be found, although we are likely to remember that no feat of research has produced a drug which did not prove toxic to a minority of those to whom it was administered.

We have to remember, also, that the briefer the action of a cycloplegic drug the greater the precision required as to timing of the examinations made under

its use, and the greater the possibility that it will not always suit the exigencies of daily practice. It is perhaps too much to hope that a powerful and rapidly acting drug would be equally effective in all patients, or that it would be uniformly free from allergic reactions or tendency to disturb the corneal surface.

A brilliant illustration of the problems to be solved and the difficulties likely to be encountered is to be found in the recent reports of Swan and White on their experiments with di-n-butylcarbaminoylethylcholine sulphate (*Archives of Ophthalmology*, 1944, volume 31, April, page 289, and elsewhere\*). The desiderata satisfied by this drug are said to be ready availability, inexpensiveness, chemical stability, bactericidal quality, and absorbability, as well as freedom from toxic reactions, from a tendency toward irritation, from vasodilatation, from production of anesthesia, and from increase in intraocular pressure.

The new drug, like homatropine, has a bitter taste. To remain stable for weeks at room temperature, it must be kept in a dark glass bottle. Heat and light result in slow decomposition, which can, however, be detected with litmus paper. Partially decomposed solutions become slightly irritating. The new drug lacks the "considerable chemical incompatibilities of the tropine alkaloids."

The effectiveness of a 7.5-percent solution is apparently about equal to that of a 5-percent solution of homatropine hydrobromide. In the 7.5-percent strength it was found to produce mydriasis and cycloplegia beginning in from twenty to thirty minutes and becoming maximal in fifty to seventy minutes. Its effect differs from that of the tropine derivatives in that its mydriasis and cycloplegia develop and wear off concurrently. Maximal ef-

\* Editor's note: See p. 933 of this issue.

fect continues for two to three hours, and the effect of a single instillation passes off completely within from seven to twelve hours. After two instillations ten or fifteen minutes apart, the effect continues several hours longer.

The amount of plus sphere accepted under the new drug averaged very slightly (0.04D.) less with the new drug than with homatropine, and only insignificant differences were found in the astigmatic measurement.

No doubt the new drug will be subjected to clinical tests at the hands of many ophthalmologists. It will be interesting to learn what seems to be the general conclusion as to substantial advantages or disadvantages of the drug as compared with homatropine. It is not likely that finality has been reached in the search for an ideal cycloplegic. Perhaps we may still hope that pharmacologic experiments will some day usher in the use of a new hyoscine or atropine derivative which will be powerful, brief in action, and free from objectionable toxic effects.

W. H. Crisp.

## EYE EXAMINATION IN SCHOOL CHILDREN

One of the most important contributions to eye welfare has been the establishment of ocular examinations in our schools. This has become almost universal in public schools and is the general practice in private schools. An important question is what should be the nature of these tests.

Factors pertaining to sight that must be considered are external diseases, central visual acuity, muscle balance and power, fields of vision, funduscopy, color discrimination, fusion, and refraction. The first two mentioned are obviously necessary if the tests are to have any value.

The central acuity of each eye at 20

feet in children is usually considered to be a good measure of the acuity at the reading distance except in the case of myopia, in which condition the test at 20 feet is probably justly regarded as the crucial one in uncovering the near sightedness, so that it is thought unnecessary to try the vision at 14 inches, and the customary visual tests in schools is only that at 20 feet.

Dr. Myrtle Mann Gillett reports in this issue on seeing defects in 2,500 non-reading children from a 20 years' study. Among other interesting findings is that approximately 25 percent of a group of 1,587 children who presumably had normal vision at 20 feet could not read ordinary type at 14 inches or less. Of these 286 could read such type at three or more feet. These reports, if confirmed, would indicate that tests at the usual reading distance should be carried out as a part of the routine visual tests of school children as well as those at 20 feet.

Another interesting point was that in about 25 percent of these children—though presumably not in just the same subjects as those previously described—no convergence could be elicited, and only a few of these children were strabismic. This constitutes an excellent argument for tests of dynamic and static muscle-balance measurements.

In order to be able to state with assurance that the child does or does not need eye care, a much more extensive examination than that usually given is necessary; really a complete eye test. Whether this should be provided by the school is another problem and not to be discussed here.

That there is often an undeveloped physio-psychologic element in nonreaders is also a well-known fact. Ophthalmologists continually examine children who are sent to them as nonreaders, most of whom have only minor refractive errors

and are surmized to lack the needed coördination of eyes and higher centers; but perhaps not sufficiently exhaustive tests have been made. There are probably not many ophthalmologists who trouble themselves to make the tests necessary to determine lack of higher coördination even if they have been trained to do so. In few small cities and not even in all large ones are there facilities for a thorough study of these patients and for giving the appropriate training that is indicated.

We can only conclude that more complete eye tests should be made both in schools and in the offices of ophthalmologists when children with reading difficulties are referred to them. If possible someone trained in psychiatry who has studied remedial reading should be the director of an organization of technicians sufficient to serve the community, to whom could be referred the cases of this character. In many cities orthoptic laboratories are handling the phase of muscle-training adequately for ophthalmologists, but the problem of remedial reading has scarcely been considered.

Lawrence T. Post.

## BOOK NOTICES

**THE PRINCIPLES AND PRACTICE OF OPHTHALMIC SURGERY.** By Edmund B. Spaeth, M.D. Third edition, thoroughly revised. Clothbound, 934 pages, 556 engravings, containing 798 figures and 6 colored plates. Philadelphia; Lea & Febiger, 1944. Price \$11.00.

One of the books that is most frequently withdrawn from the library of the Department of Ophthalmology in Washington University is this book on ophthalmic surgery. The third edition is even better than the previous two in that the size has been reduced, but the ma-

terial increased. It is surprising how much material has been included in this book and how exact it is. Any who neglected to buy either of the first two editions should certainly not fail to own the third.

Almost every outstanding ophthalmic surgeon's contributions to our specialty are included. Illustrations are especially noteworthy and definitely accomplish their purpose of instruction.

Lawrence T. Post, M.D.

**TRANSACTIONS OF THE AMERICAN OPHTHALMOLOGICAL SOCIETY**, volume 41, 1943. Clothbound, 628 pages. Printed by Wm. F. Fell Co., Philadelphia, Pennsylvania.

The seventy-ninth annual meeting of the American Ophthalmological Society was held at Hot Springs, Virginia, on June 10, 11, and 12, 1943. Dr. Hunter McGuire presided. In this publication are 32 papers, including 9 theses. Twenty of the articles deal primarily with ocular pathology, four with surgical procedures, and three with therapeutic measures. Eighteen of the essays have been published or accepted for publication in the American Journal of Ophthalmology and are not included in this review.

The diagnosis, classification, and therapy of keratoconjunctivitis sicca are discussed by the late Sanford Gifford, Irving Puntenney, and John Bellows. The use of gelatin in Locke's solution in mild cases with closure of the canaliculi also in more severe cases has given satisfactory results.

The distribution of certain oxidative enzymes in the ciliary body has been investigated by Jonas S. Friedenwäld, Heinz Herrmann, and Robert Moses. Original methods of isolating the secretory portion of the ciliary body were described.

The visual-field studies, following surgical division at the chiasm of the crossed macular fibers, were made by John N. Evans and Jefferson Browder. The visual acuity resulting from division of the crossed macular fibers was approximately 20/40. The authors conclude the entire macula may be supplied by both crossed and uncrossed fibres.

The relationship between retinal detachment and trauma has been investigated in 400 successive cases by Arnold Knapp. Myopia was encountered in 50 percent; trauma, direct or indirect, in 12 percent; aphakia in 9 percent. The detachments were bilateral in 14 percent. The role of indirect trauma (strain, lifting, coughing), in producing a detachment, is obscure.

Histologic sections of a case of primary retinal tuberculosis and one of Boeck's sarcoid of the retina were presented by Alexander E. MacDonald.

The treatment of corneal opacities by keratectomy was described by Ramón Castroviejo. Excellent photographs of the various surgical procedures were presented. Use of opaque corneal tissue to enlarge the cul-de-sac was recommended.

A study of the lenses in 20 globes that had suffered from nontraumatic iritis was made by Bernard Samuels. Folds in the lens capsule, changes in the epithelium, death of the subcapsular epithelium, and changes in the substance of the lens were noted.

A discussion of a case of recurring attacks of concomitant exotropia, each followed by transient esotropia, was presented by F. H. Verhoeff. A vasomotor disturbance of the nuclei of the interni or in the convergence center was thought to be associated with migraine.

Raymond L. Pfeiffer studied 120 cases of fracture of the bones of the face in which the orbit was involved, and in 53

enophthalmos developed. The usual fracture was in the orbital floor, with displacement of the orbital contents into the maxillary sinus. Roentgenography was required for diagnosis. Methods of treatment were described.

A case of tuberous sclerosis was recorded by Ernest F. Krug and Francis A. Echlin.

A new treatment of foreign bodies of the cornea was described by D. F. Gillette. The area of the foreign body is touched lightly with silver nitrate, 1 percent; this causes swelling and softening of the superficial tissue. After one minute the foreign body may be removed with a softened wooden toothpick or cotton-wound applicator. With the aid of pigment staining of the cornea the ring is readily removed with the point of a cystotome.

A review by Frank N. Knapp of the literature on the treatment of ocular tuberculosis reveals the difficulty of establishing the diagnosis and the multiple methods of treatment recommended. The ideal treatment should include the routine followed in the sanatorium for tuberculous patients. The use of tuberculin, radium, X-ray, gold, hemotherapy, typhoid-H antigen, and typhoid vaccine are considered in this article.

Lipaemia retinalis occurs in the nondiabetic when the blood-fats rise above 3.5 percent and disappears when the blood-fats fall below 2.5 percent. A case in a nondiabetic was investigated and reported by Cecil W. Lepard.

The material presented in this volume, edited by Wilfred E. Fry, is free of war material, shortages, or controversy. The work advances the traditional standards of American ophthalmology.

William M. James.



## CORRESPONDENCE

## LENSES FOR AVOIDING DIPLOPIA

July 29, 1944

To the Editor,

American Journal of Ophthalmology:

In the discussion of spinal anesthesia followed by paresis of the external rectus muscle, Dr. L. R. Lang suggested giving the patients glasses in which the outer half of the lens in front of the involved eye is occluded, thereby eliminating diplopia in the affected field (Amer. Jour. Ophth., 1944, v. 27, p. 772).

When, in 1927, I published a paper entitled: "Partially frosted lenses and biprismatic lenses in the treatment of ocular muscular disturbances" (Klin. M. f. Augenh., v. 79, p. 211), I considered the same scheme; that is, placing a partially frosted lens before the involved eye. Later on, I improved this method, using the partially frosted lens corresponding to the *not* involved eye in cases of paresis of the external rectus muscle; the nasal half of the lens before the nonparetic eye was frosted to avoid the loss of the temporal half of the visual field of the paretic eye; thus, the patients did not notice any discomfort resulting from diplopia, and were not as much incapacitated as with a shielded temporal half of the visual field.

These partially frosted lenses were used in acute cases. When, after some

months, the paresis and diplopia did not disappear entirely but the distance of the double images grew smaller, I used biprismatic lenses; that is, a lens one half of which was combined with a prism. For external rectus paresis, this prism is to be fitted with its base out, and its extent and strength should depend on the severity of the paresis. Usually, the full temporal half of the lens was covered by the prism, base out. This, of course, did not prevent diplopia in extreme lateral rotation, due to the increase of the diplopia with gaze in the direction of the action of the paretic muscle; but in mild cases, it was sufficient to prevent annoying double images for the usually needed range of lateral rotations.

(Signed) K. W. Ascher.

## CORRECTION

July 19, 1944

To the Editor,

American Journal of Ophthalmology:

India being so far away, I have finally received a copy of my paper on Binasal hemianopsia. I wish to correct one typographical error. The patient was first admitted to Children's Hospital (Cincinnati, not Chicago). He was later observed in the Eye Department of the Cincinnati General Hospital.

(Signed) Irwin E. Gaynon,  
Capt. (MC).

# ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

## CLASSIFICATION

- |  |  |
|--|--|
| 1. General methods of diagnosis                        | 10. Retina and vitreous                                |
| 2. Therapeutics and operations                         | 11. Optic nerve and toxic amblyopias                   |
| 3. Physiologic optics, refraction, and color vision    | 12. Visual tracts and centers                          |
| 4. Ocular movements                                    | 13. Eyeball and orbit                                  |
| 5. Conjunctiva   | 14. Eyelids and lacrimal apparatus                     |
| 6. Cornea and sclera                                   | 15. Tumors   |
| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries   |
| 8. Glaucoma and ocular tension                         | 17. Systemic diseases and parasites                    |
| 9. Crystalline lens                                    | 18. Hygiene, sociology, education, and history         |
|  | 19. Anatomy, embryology, and comparative ophthalmology |

### 9

#### CRYSTALLINE LENS

Bellows, J., and Nelson, D. Cataract produced by anoxia. *Arch. of Ophth.*, 1944, v. 31, March, pp. 250-252.

The transparency of the crystalline lens depends on proper utilization of nutrient material supplied by the aqueous. If for any reason there is a local deficiency of some vital constituent, the lens becomes opaque. The most vital requirement of tissue is an adequate supply of oxygen. The necessary rapid replenishment of oxygen in the aqueous is made possible by rapid diffusion from the ciliary body and by passage of oxygen from the atmosphere through the cornea.

The authors undertook experiments to determine whether anoxia alone would produce cataract. Rats were placed in a steel chamber in which the pressure was gradually reduced. When the conditions were severe enough to cause death of 50 percent of the animals, it was found that about 75 percent of the dead animals and 10 percent of the survivors had lens opacities.

That the cataracts were influenced by anoxia was demonstrated by control experiments in which rats were placed singly in glass chambers arranged to permit the constant flow of gases at sea-level pressure. Again the rats showed lens opacities, but to a lesser degree.

Rabbits were used to determine the lactic-acid content of the aqueous, as these animals are known to be resistant to changes in altitude. The aqueous was removed from one eye of each animal under ether anesthesia. After recovery for two hours, some of the animals were put in cases as controls, and the others were placed in the decompression chamber. After two hours the pressure in the chamber was restored to the normal level, the animals were anesthetized again, and the aqueous was removed from the second eye. Whereas the average lactic-acid content of the aqueous in all the eyes first studied and in the second eyes of the control rabbits ranged from 70 to 75 mg. per hundred c.c., the average lactic-acid content of the aqueous in

the second eyes of the animals in the decompression chamber was three to four times as high.

In some sections of cataract due to anoxia, there were noted subepithelial vacuoles, clumping of nuclei, and exudate on the lens capsule. After decompression there was conspicuous hyperemia of the iris. With oblique illumination, small diffuse gray opacities were seen in the superficial part of the cortex. With the higher magnification of the slitlamp, the changes were seen to begin with opacification of the anterior sutures, from which fine fibrillar opacities extended. In optical section it was seen that the entire opacity was thin and lay in the superficial layers of the cortex. Gradually the opacity extended toward the periphery. The opacity lasted from about three quarters of an hour to one hour and then gradually retrogressed, the order of retrogression retracing exactly the course of development, so that the last opacities to disappear were those about the sutures.

Examination revealed no changes in the lenses of human volunteers placed in the decompression chamber. (References, 3 figures.)

R. W. Danielson.

Clapp, C. A. A report on a family with ectopic lenses. *Amer. Jour. Ophth.*, 1944, v. 27, July, pp. 738-740. (Illustrations, references.)

Foglia, V. G., and Cramer, F. K. Experimental production of diabetic cataract in the rat. *Proc. Soc. Exper. Biol. and Med.*, 1944, v. 55, March, p. 218.

Male white rats were almost completely pancreatectomized by the authors, leaving between 5 percent and 20 percent of the organ. The blood-

sugar level was determined and a standard diet given. The lens lesions which occurred were classified in four degrees of increasing severity, as follows: type A, alteration of the anterior capsule of the lens (rugosity); type B, opacity of the lens sutures; type C, partial opacity of the lens parenchyma; type D, total opacity of the lens parenchyma.

All of 41 rats with only 5 percent of the pancreas developed cataracts in fifty days or more. These cataracts were progressive, and varied in severity directly with the height of the fasting blood sugar. Very few rats with a normal level of blood sugar had lesions, whereas all rats with a level greater than 220 mg. had lesions of the most serious types, C or D. The rats with 20 percent of the pancreas showed a lower incidence of diabetes and correspondingly less frequent and less severe lens lesions. These cataracts took over 200 days to appear, and were never more severe than type B. In one hundred normal rats taking the same diet no similar lesions were seen.

Robert N. Shaffer.

Friedman, B. B. Treatment of epithelial ingrowth following cataract extraction. *Amer. Jour. Ophth.*, 1944, v. 27, July, p. 764.

Harned, J. W. Pseudoaphakia fibrosa. *Arch. of Ophth.*, 1944, v. 31, March, p. 253.

Harned reports a case the details of which suggested that the defect was not primary aphakia, but secondary aphakia, or pseudoaphakia, from degenerative changes occurring in the lens during the fifth week of embryonic life, as described by Mann.

R. W. Danielson.

## 10

## RETINA AND VITREOUS

Figueiredo, N. P. de. A case of persistent hyaloid artery. *Rev. Brasileira de Oft.*, 1944, v. 2, March, pp. 121-123.

The patient, a white man of 26 years, had a left eye which deviated slightly upward and inward, had never seen well, and the visual acuity of which was limited to one tenth. There was a small white opacity at the posterior capsule of the lens, and from this position a fluffy fine thread extended far backward into the vitreous. With movements of the eyeball, the thread moved freely in all directions. This structure was interpreted as representing persistence of the obliterated hyaloid artery. The author reviews ten references from the literature.

W. H. Crisp.

Gifford, S. R. An evaluation of ocular angiospasm. *Trans. Amer. Acad. Ophth. and Otolaryng.*, 1943, 47th mtg., Sept.-Oct., pp. 19-30.

Methods of studying peripheral circulation are reviewed. Three fairly well-defined types of ocular pathology are described in which peripheral angiospasm seems to be a causative factor. The first is a central angiospastic retinopathy, the typical picture of which is sudden reduction of central vision in one or both eyes with edema of the macular area. The average age of patients was 36 years. Nearly all smoked. Normal vision, or nearly normal vision, was restored in two to six weeks of antispasmodic treatment, which is described in detail.

The second type is periphlebitis retinae with recurring vitreous hemorrhages in young adults. Although in the majority of these tuberculosis is of causative importance, in a small

group peripheral vascular disease seems to be of primary importance. These may well be given the benefit of treatment to improve the peripheral circulation.

For the fourth type a case is presented of extreme attenuation of the retinal arterioles in a postoperative cataract patient who showed marked peripheral angiospasm and improved on antispasmodic treatment. It is suggested that in these three syndromes an examination of the peripheral vascular system is indicated. Such an examination is advised also in other conditions in which vasodilators are to be used. (One table, 2 illustrations, references.)

Katharine H. Chapman.

Landau, A., and Ruszkowski, J. A case of exudative and hemorrhagic retinitis, with increased intraocular tension, treated by pilocarpine and thyroid. *Brit. Jour. Ophth.*, 1944, v. 28, April, pp. 184-187.

The patient was a woman forty years of age who reported for examination because of a blind painful right eye. She gave a history of injury above her right eye in a motor accident in 1937. A week after the accident she noticed a dark spot in front of the right eye. A patchy retinal hemorrhage was found by an ophthalmologist. Following the accident, her vision became steadily worse. Two months after the accident, another oculist found the tension increased and performed an anti-glaucomatous operation. The sight continued to fail and in 1939 the eye became totally blind and painful. On examination the tension was found to be 90 mm. Hg (Schiotz). The cornea was cloudy and the anterior chamber was half filled with blood. The fundus could not be seen. The left eye showed

no pathologic changes, the tension was normal, the vision 6/5. The right eye was enucleated.

Five months later the patient re-entered the hospital with a history of a dark spot appearing before the left eye, a week after dental extractions. Examination of the eyeground revealed numerous hemorrhages and exudates near the optic disc. The vision was decreased to 6/18. The patient was readmitted to the hospital. During the first month the vision continued to decrease and eventually there was an attack of glaucoma with high tension. The attack was relieved by pilocarpine but the vision has decreased to counting fingers at 18 inches. In order to keep the tension down it was necessary to instill 2-percent pilocarpine three or four times daily.

It was clear that the morbid process in the left eye was a repetition of that in the right eye. The fundus picture was similar to that of severe hypertensive retinopathy. Taking into consideration the fact that the retinal changes in hypertension are caused by diseased arterioles and since the patient's blood pressure was normal (120/90), the author was forced to conclude that this was a case of arteriolitis of unknown origin. Foreign-protein shock-therapy was started, injections of sterilized milk being given every second or third day. After the third injection (15 c.c.) the patient had a high fever and a glaucomatous reaction, which was attributed to spasm of the arterioles. Persistent instillation of pilocarpine stopped the attack of glaucoma.

French publications (Chaufford, 1920) have shown that exudative patches of retinitis contain many lipoids and that such retinopathy is

associated with hypercholesterolemia. The blood cholesterol of this patient was 180 mg. percent and her basal metabolic rate was minus 10 percent.

Thyroid tablets one grain thrice daily were given from July 29 to October 10, 1942. From the beginning of this treatment, the vision started to improve. There were no more attacks of glaucoma. To avoid the tachycardia and other general actions of the thyroid, half a grain of phenobarbitone was used twice daily. From October 10, 1942, until January 16, 1943, the thyroid was discontinued. During this period the patient was given injections of acetylcholine, and for many weeks afterward she was given nicotinic acid because of its vasodilator action. Since January 16, 1943, she has been taking thyroid again, one grain every second day with phenobarbitone half a grain twice daily. Vision has increased to 6/18. Pilocarpine once daily controls the tension.

The author assumes that the thyroid treatment prevented glaucoma from taking a hemorrhagic, malignant course, and he recommends that cases of retinopathy of unknown origin be treated by vasodilator methods.

Edna M. Reynolds.

Lijó Pavía, J., and Cerboni, F. C. Concerning double retinal pulsation and its cinematographic record. *Arch. de Oft. de Buenos Aires*, 1942, v. 17, Aug., p. 485.

The authors studied by means of retinocinematography the so-called double retinal pulsation produced by application of the pressure of the ophthalmodynamometer, which elicits a venous pulsation at the same moment that the arterial pulsation appears. Bailliart considered this to be due to an obstacle in the return venous

circulation, and the authors present a case in support of this opinion. A 53-year-old man with systemic hypertension showed numerous retinal hemorrhages and edema in the fundus of the right eye, due to obstruction of the central retinal vein. When a tonoscopic examination was carried out, the double retinal pulse was observed and recorded on a cinematographic film at a speed of 24 frames per second. A more detailed study was made possible by increasing the speed to 62 frames per second, which made the projection time of the interval between pulsations slightly longer than one second.

Plinio Montalván.

Remonda, Juan. Congenital fold of the retina. *Arch. de Oft. de Buenos Aires*, 1942, v. 17, Sept., p. 586.

A case of congenital fold of the left retina is presented. The literature is discussed in detail. (Illustrations.)

Plinio Montalván.

Veirs, E. R. Retinal detachment seen in an Army general hospital. *Southern Med. Jour.*, 1944, v. 37, April, pp. 224-226.

The 21 cases reported represented 4.9 percent of the total admissions, the average age being 27.8 years. All were unilateral and 11 were surgically treated. Only 23.8 percent were myopic and about 20 percent were of traumatic origin. More than one-half had tears or holes. Diathermy was used in all the surgically treated. Machines especially constructed for detachment work are not considered essential. Retrobulbar injection of 2-percent procaine with topical applications of 2-percent butyn were used. A flattened retina immediately after operation is considered a good prognostic omen, and associated local evidence of infec-

tious disease suggests a worse prognosis.

Charles A. Bahn.

Vidal, F., and Malbran, J. L. The path of the inferior peripheral homolateral fibers in the cat. Retinal microlesion. *Arch. de Oft. de Buenos Aires*, 1942, v. 17, Sept., p. 521. (See Section 19, Anatomy, embryology, and comparative ophthalmology.)

Wyburn-Mason, R. Arteriovenous aneurysm of mid-brain and retina, facial nevi, and mental changes. *Brain*, 1943, v. 66, Sept., pp. 163-203.

An attempt is made to define the condition in which an arteriovenous aneurysm of the mid-brain is associated with congenital anomalies of the retinal vessels, with often a tract of vascular tissue connecting the two lesions, a vascular nevus in the neighborhood of the affected eye, and perhaps mental symptoms. Figures showing the peculiar appearance of the ocular fundus are reproduced from the articles of various authors. One plate shows a coronal section of the upper part of the pons, mid-brain, and the region of the third ventricle, with an arteriovenous aneurysm of the dorsum of the mid-brain invading the right side; and a transverse section of the pons and the upper part of the cerebellum, showing extension of the aneurysm into the upper part of the ventricle, together with a drawing of the corresponding fundus. An embryologic explanation of the condition is offered, and the differential diagnosis is discussed. Several cases which appear in the literature are summarized, with comments on the pathology, an interpretation of the ophthalmoscopic appearance, and discussion regarding histologic examinations of retina and nevi, as well as concerning psycho-

somatic symptoms. Also considered are cerebrospinal fluid, radiography, encephalography, ventriculography, arteriographic findings, relationship to other retinal vascular anomalies, and treatment. (26 figures, references.)

M. Lombardo.

## 12

### VISUAL TRACTS AND CENTERS

Araujo, Helio de. Snake poisoning and ocular disturbances. *Arquivos da Soc. de Med. e Cir. de Ilheus*, abstracted in *Arquivos Brasileiros de Oft.*, 1943, v. 6, Dec., p. 222. (See Section 16, Injuries.)

Crespi Jaume, Gonzalo. Unilateral ocular secretomotor syndrome. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1942, v. 1, Nov.-Dec., pp. 601-612.

Case report of paralysis of the left external rectus, associated with absence of lacrimal secretion and mydriasis in the same eye. The patient was affected with essential hypertension. The author discusses at length the pathogenesis of this condition, concluding that the lesion, possibly of vascular origin, affected both the nucleus of the sixth nerve and the nucleus controlling lacrimal secretion. The mydriasis could be explained by irritation of the sympathetic. (3 figures, references.)

Ramón Castroviejo.

Duenas, Alfredo. Diagnosis of localization of optic-tract lesions. *Medica*, 1944, v. 3, May-June, pp. 63-95.

A 33-page review of the subject, from a Cuban author.

Falcão, Pedro. Contribution to the study of cerebral localization. *Arquivos Brasileiros de Oft.*, 1944, v. 7, Feb., pp. 1-13.

This is a short summary of the bearing of the various cranial nerves upon cerebral localization, particularly in relation to certain signs and syndromes.

McAlpine, P. T. Hysterical visual defects. *War Med.*, 1944, v. 5, March, p. 129.

Many functional ocular complaints are precipitated by the rigors of army life. Among the hysterical patients the most common symptoms are asthenopia and blepharospasm. Slightly less common are spasms of convergence and accommodation, anomalies of conjugate deviation and of muscle excursion. Least common is hysterical amblyopia. This last must be differentiated from retrobulbar neuritis, toxic neuritis, and amblyopia due to psychosis or disease of the central nervous system. Nine cases of hysterical visual defect and one of dementia precox simulating hysteria illustrate these statements. Unfortunately, in most of these cases adequate psychiatric examinations could not be obtained.

Robert N. Shaffer.

Rezende, J. de, Jr., and Estrada, W. D. Mixed syndrome of the orbital apex and the foramen rotundum. *Rev. Brasileira de Oft.*, 1943, v. 1, March, pp. 149-155.

A man of 23 years was wounded with a shoemaker's knife which, as regards the head wound, penetrated deeply in the temporal region, cutting the superficial temporal artery. There was ptosis of the left upper lid, great reduction in visual acuity on the same side, paralysis of all the external ocular muscles, and hypesthesia of the corresponding supraorbital region. The patient was somnolent. The left cornea and conjunctiva were completely anes-



thetic. A month later the patient had recovered from the general effects of his wounds, but the vision of the left eye was entirely abolished, the optic disc atrophic, and the external musculature of the eye almost completely paretic, although the lid elevator had recovered its function. The anatomic diagnosis is expressed in the title of the article. (6 photographs.)

W. H. Crisp.

Subirana, A. The classic concepts and modern neurologic acquisitions concerning oculomotor physiopathology. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1942, v. 1, Nov.-Dec., pp. 578-592.

Brief analysis of some of the most frequent cerebral syndromes associated with ocular paralysis. The differential diagnosis of these syndromes is also briefly discussed. (References.)

Ramón Castroviejo.

Wyburn-Mason, R. Arteriovenous aneurysm of mid-brain and retina, facial nevi, and mental changes. *Brain*, 1943, v. 66, Sept., pp. 163-203. (See Section 10, Retina and vitreous.)

### 13

#### EYEBALL AND ORBIT

Corrêa Netto, Orozimbo. Considerations in regard to a case of complete albinism of the eyes. *Arquivos Brasileiros de Oft.*, 1944, v. 7, Feb., pp. 13-19.

The only five such cases which the author has observed clinically were of the masculine sex and the white race. The patient whose case is described here was a Syrian, aged 22 years. He had a moderate hyperopia and was able to distinguish colors. The author believes it is a mistake to regard these patients as having a congenital weak-

ness of the retina. Albinos should not be permitted to intermarry. (One photograph.)

W. H. Crisp.

Davis, J. S. Osteomyelitis with fistula, orbital cellulitis and abscess, and diplopia complicating pansinusitis. *Annals of Otol., Rhin., and Laryng.*, 1943, v. 52, Dec., p. 906.

The author reports this case because it presents several complications of nasal sinus infection at one time, with recovery.

On January 1, 1943, the patient developed an "acute head cold," followed one week later by severe pain over the left eye. Two days later, swelling and redness of the left upper lid were present. This swelling continued for several weeks and gradually fluctuation developed. In April a horizontal incision was made into the localized swelling and pus escaped. The incision did not heal, but a fistula developed which continued to drain.

X-rays of the sinuses in February, 1943, revealed pansinusitis on the left side; X rays in March and April showed progression of the pathology with necrosis of the floor of the left frontal sinus; X rays in May showed further progression of the disease and revealed a fistula when radiopaque material was injected through the incision in the eyelid.

Eye findings in May, 1943: vision normal in each eye; diplopia present for past two months; left eyeball displaced downward; right lids normal; a sanguinopurulent discharge exudes from left upper lid, where there is a gaping horizontal incision, surrounding this area are redness and induration; right conjunctiva normal; chemosis of the left bulbar conjunctiva, palpebral conjunctiva slightly injected; media clear, fundi normal.

Radiographs showed marked irregularity of the margins of the left frontal sinuses, with some clouding, and a loss of substance along the left orbital ridge. Diagnosis: chronic suppurative pansinusitis, with osteomyelitis of the orbital plate of the left frontal bone, fistula, orbital abscess, and cellulitis and diplopia. When adequate medical care failed, recovery was brought about by radical surgical procedures.

Theodore M. Shapira.

#### 14

#### EYELIDS AND LACRIMAL APPARATUS

Blumenfeld, Louis. Rhinocanalicular anastomosis with reconstruction of the lacrimal sac. *Arch. of Ophth.*, 1944, v. 31, March, pp. 248-249.

In the present report, the author gives a detailed and technical description of his new operative procedure on the lacrimal drainage system. He says that the results of the better-known procedures, namely, those of West, Toti, Mosher, and Halle, have often been disappointing because they use as part of their reconstructive tissue a lacrimal sac that is chronically diseased, fibrotic, the site of strictures, and often in a state of active suppuration. In the author's procedure, healthy normal tissues are used throughout the entire reconstructed lacrimal system, so that the danger of subsequent granulation and stricture is minimized.

The paper includes a very detailed case history of a patient on whom this procedure was used. (4 illustrations.)

R. W. Danielson.

Fernández, J. M. M., and Soto, M. C. Tuberclelike leprotic lesion of the eyelid. *Arch. de Oft. de Buenos Aires*, 1942, v. 17, Aug., p. 462.

A 33-year-old white woman pre-

sented a tumorlike infiltrative lesion of the right upper lid extending over the outer two thirds of the ciliary border horizontally, and vertically to the midpoint. This lesion was prominent, violet in its lower portion and ochre-yellow in the rest, and showed marked congestion over its whole surface. There was fine desquamation, and palpation did not elicit any pain. Immediately above this lesion there was a small nodule of the size of a grain of rice and violet in color. There was complete anesthesia to heat, pain, and touch over the areas covered by these lesions. General physical examination, especially of the skin and mucous membranes, was essentially negative. No acid-fast bacilli were found, but histopathologic examination resulted in diagnosis of tuberculoid leprosy. Marked improvement was obtained with chaulmoogra esters. The interest of this case lies in the rarity of leprotic involvement of the eyelid as solitary manifestation of the disease, and in the diagnostic aid rendered by clinical investigation of the sensitivity of the affected region. (Illustrations, photomicrographs.) Plinio Montalván.

Lachman, R. Dacryocystitis treated with sodium sulfapyridine. *Rev. Oto-Neuro-Oft.*, 1943, v. 18, Sept.-Oct., pp. 150-151.

The author claims cure of three cases of purulent dacryocystitis with sac irrigations using a solution of soludagenan (sodium sulfapyridine).

Edward Saskin.

Marback, H. Partial loss of eyelashes. *Arquivos Brasileiros de Oft.*, 1943, v. 6, Dec., pp. 211-212.

Under the Portuguese title of "Pelada da palpebra" (baldness of the lid), the author reports the case of a

white boy aged 14 years, who came complaining that the lashes were falling out of the outer half of the left eyelids. The boy was of apparently normal build, there was no suggestion of mental disturbance, and there was no evidence of syphilis in the family. The outer half of the left upper lid had no lashes. Three "atrophied" lashes at the nasal end of this defective area came out under very slight traction. There was no blepharitis, and upon expression the meibomian glands yielded normal secretion. The visual apparatus and its adnexa were otherwise normal. There was no abnormal absence of hair on other parts of the body. The patient was watched for forty days, and was then treated empirically with bismuth iodide of quinine. At the end of three months there was no longer any defect as to the lashes, and the condition has since remained normal. (One photograph.)

W. H. Crisp.

Paula Xavier, J. de. Phenomenon of Marcus Gunn. *Arquivos Brasileiros de Oft.*, 1943, v. 6, Dec., pp. 213-217.

The patient was a white Brazilian schoolboy aged 11 years. Since the earliest months of life the parents had noticed defective opening of the right eye. Seven excellent photographs show complete closure of the right eye in repose, and more or less complete opening of the eye upon opening the mouth, in movements of the lower jaw to right or left, in protrusion of the mandible, in contraction of the frontalis muscle, and during mastication. The right eye was deviated strongly downward, and this position of the eyeball was not modified by the various actions of the jaw. The pupillary reactions were normal, but the right

pupil had a moderate amount of ectopia, the pupil being displaced upward and inward. The uncorrected vision of the right eye was one sixth, unimproved by lenses, while the corrected vision of the left eye was one half. The effect of lateral movements of the mandible was also manifested with the mouth closed.

W. H. Crisp.

Spaeth, E. B. Ptosis, posttraumatic and hysterical. *Amer. Jour. Ophth.*, 1944, v. 27, July, pp. 687-692. (3 figures.)

Vila Ortiz. Contribution to the bibliography of the phenomenon of Marcus Gunn. *Arch. de Oft. de Buenos Aires*, 1942, v. 17, Sept., p. 537.

The author reports the case of a 32-year-old woman who showed the typical phenomenon of Marcus Gunn. There was partial ptosis of the left upper lid. During voluntary movements of the lower jaw, the ptosis disappeared entirely and was superseded by marked retraction. The condition was congenital. The literature on the subject is briefly reviewed. (Illustrations, bibliography.)

Plinio Montalván.

## 15

### TUMORS

Ellett, E. C. 1. Metastatic carcinoma of the choroid. 2. General metastasis from a melanoma of the abdominal wall, with paresis of the external rectus muscle. 3. Rubeosis iridis, with melanoma of the choroid and secondary glaucoma. *Amer. Jour. Ophth.*, 1944, v. 27, July, pp. 726-731; also *Trans. Amer. Ophth. Soc.*, 1943, v. 41, p. 157.

Titche, L. L. Epithelioma of the conjunctiva. *Med. Bull. Veterans' Admin.*, 1944, v. 20, April, p. 449.

A reddish elevated mass about 1 by 0.5 cm. overlapped the basal cornea 2 mm. It was freely movable with the conjunctiva and contained numerous small vessels. The eye was otherwise normal. The tumor was excised under local anesthesia. It was diagnosed microscopically as "epidermoid carcinoma, papillary type, low grade." Five months later, only slight conjunctival injection was visible at the site of the tumor. Movability of the conjunctiva convinced the author that no recurrence had occurred.

Charles A. Bahn.

Trevor-Roper, P. D. Case of neurofibroma of the choroid. *Brit. Jour. Ophth.*, 1944, v. 28, April, pp. 177-180.

The presenting symptoms of this case were proptosis of the left eye with some limitation of all movements, especially on looking upward. Ophthalmoscopic examination revealed a globular mass almost filling the superotemporal quadrant, with distinct choroidal and retinal blood vessels overlying. X-ray and general examination showed no evidence of metastases or other abnormalities.

Upon exploration of the left orbit, a firm, circumscribed tumor was found extending back from the sclera toward the apex of the orbit. Exenteration of the orbit was done. The socket healed well and has given no trouble. (Date of operation May 14, 1943.)

Pathologic examination revealed a whitish mass adherent to the globe in the region of the insertion of the superior oblique muscle. This mass was irregularly lobulated and was equal in size to the eyeball itself. It was encapsulated and did not invade the

orbital tissues. The choroid and retina were stretched over the surface of the tumor. A fairly large scleral perforation was present and the scleral edges had caused constriction of the tumor mass. The sclera was not invaded and its margins appeared to have been separated by direct pressure.

The tumor was composed of elongated cells showing well marked parallel arrangement with many areas of palisading. The tumor was unusually cellular and showed some mitoses. There were well developed fibrous septa, and some small areas of hemorrhage and degeneration were present. The general appearance did not suggest malignancy. The origin of the growth was probably in the intrascleral portion of one of the ciliary nerves, and this would explain the intraocular and extraocular extensions of a noninvasive tumor.

There was no evidence of generalized Recklinghausen's disease and no family history of that disease. (2 illustrations, references.)

Edna M. Reynolds.

## 16

### INJURIES

Araujo, Helio de. Snake poisoning and ocular disturbances. *Arquiv. da Soc. de Med. e Cir. de Ilheus*, abstracted in *Arquivos Brasileiros de Oft.*, 1943, v. 6, Dec., p. 222.

The abstract (by Durval Prado) gives the following details: A 25-year-old Mulatto was bitten by a cobra on the back of the right foot. Six hours after the accident he noted that his right eye "began to swell." In the course of the following day, the vision of this eye was gradually lost. A day later, the patient sought medical care for hematuria, buccal hemorrhages,

and abdominal pains. The right eye protruded, and there was an intense conjunctivitis, with corneal ulcer and opacity of the crystalline lens. The left eye was normal. There were no muscular paralyses. The exophthalmos disappeared after a week, but the eye had to be enucleated. The case is perhaps poorly authenticated. Certain cobras project their venom directly into the eyes of their victims, but no such statement is made with regard to the present case.

W. H. Crisp.

Berezinskaja, D. I. Corneal transplantation in chemical burns of the eyeball. *Viestnik Oft.*, 1942, v. 20, pts. 1-2, p. 19. (See Section 6, Cornea and sclera.)

Denig, Rudolf. Prolapse of the uvea. *Arch. of Ophth.*, 1944, v. 31, March, pp. 232-241.

This paper consists of a detailed analytical discussion of the treatment of prolapse of the iris or ciliary body depending on size and location of prolapse, age of patient, and amount of inflammation. Ordinarily, one thinks of simple excision of a prolapse of the iris, but the author speaks of an iridectomy on each side and terms the procedure "isolation." He says that isolation of a prolapsed portion of the iris consists of complete interruption of connection with its trunk and exclusion from the irritation emanating from the seat of incarceration. Bilateral cyclectomy would have the same effect for an old inflammatory prolapse of the ciliary body.

Denig quotes Spies as saying that the inflammation will not become manifest if the reflexes passing from the focus of inflammation to the centripetal sensory nerves can be ex-

cluded. Spies also claims that an already existing inflammatory reaction will heal rapidly after anesthetization of the focus of inflammation. Bruce had followed up these ideas of Spies by studying: (1) the effect on the inflammatory process of transverse section of the spinal cord; (2) the effect of division of the posterior roots on the inflammatory process; (3) the results of experiments on nerve endings.

Denig's experiments are reported under the following headings: (1) scarification of unilateral lacerated subconjunctival prolapse of the uvea; (2) scarification of bilateral lacerated subconjunctival prolapse of the uvea; (3) after unilateral lacerated subconjunctival prolapse of the uvea, strengthening of the sensory vasomotor reflex by psychic influence.

The author then gives a detailed discussion of the pathology and etiology of sympathetic ophthalmia, and proposes a new idea that there may be psychic factors in the causation, so that there would be a possibility of psychotherapy in prevention and cure of the condition. He argues that, next to uveal injury and continued uveal irritation, the vasomotor psychoreflex is the third fundamental factor in sympathetic ophthalmia. (References.)

R. W. Danielson.

Gomes, Brenno. External ophthalmoplegia from crotal (snake) poison. *Ophthalmos*, 1943, v. 3, no. 2, pp. 187-194.

The snake family Crotalidae is abundantly represented in Brazil. The author reports three cases of poisoning by a Brazilian cobra (tropical rattlesnake), the technical name of which is significantly *Crotalus terrificus terrificus*. The first patient was a mulatto boy aged 14 years. A wound by a cobra

at the root of the left thumb was immediately followed by disturbance of vision, with inability to raise completely the upper lids. He was also unable to open the mouth completely or to protrude the tongue, and swallowing was difficult and painful. When seen two days later he had complete bilateral internal and external ophthalmoplegia. The second patient, a mulatto child aged eight years, stung on the dorsum of the left foot showed similar ocular conditions, but was in a prostrated and semiunconscious condition, and died shortly. The third patient, a man of 27 years, stung in the forearm, had bilateral external ophthalmoplegia. The first and third patients recovered. The mechanism by which the poison produces these results is unknown. In the cases which survive, the ocular disturbances are transitory. (3 illustrations.)

W. H. Crisp.

Harley, R. D. Keratoconjunctivitis caused by the manzanillo tree. *Amer. Jour. Ophth.*, 1944, v. 27, June, pp. 628-631. (References.)

Katznelson, A. B., and Smelansky, P. I. Results of magnet extraction of intraocular foreign bodies. *Viestnik Oft.*, 1942, v. 20, pt. 3, p. 14.

This is an analysis of 522 cases with successful extractions in 430. The investigation especially sought to determine the significance of the preoperative state of the eye, and the promptness of surgical interference, as factors in the visual result. The tabulated data show that in the presence of infection the results were poor regardless of the promptness with which the foreign body was extracted. Of cases with traumatic iridocyclitis and uveitis the visual results were better in those cases

in which surgical extraction of the foreign body was delayed beyond 4 to 10 days. In another series of noninfected cases the results showed gain with surgical delay. The percentage of unfavorable results is higher in cases operated within the first few days.

One table shows the effect of location of the foreign body on final visual acuity. The best results were obtained when the foreign body was located in the anterior ocular segment; but location in the lens vitiated the prognosis. The prognosis became graver with increase in size of the foreign fragment; most of the large foreign bodies were in the posterior ocular segment. With fragments of equal size the prognosis was more favorable if located in the anterior ocular segment. In the same location the prognosis for visual acuity got poorer with increase in size of the foreign body. Injuries to the lens vitiate the prognosis, especially if lens masses escape into the anterior chamber. The most favorable point of entry is the scleral region, but the least favorable prognosis is after injuries of the ciliary body. Corneal perforations are more apt than scleral to become infected. The anterior route for extraction was used in 287 cases. With the foreign body located in the posterior ocular segment it is extracted by the anterior route if the corneal wound is gaping and the foreign body in the vitreous does not exceed 3 mm. in size; if the lens is injured and opaque; and in relatively fresh cases, with fragments smaller than 3 mm., and with transparent lens. The posterior route was successful in 144 cases. These were cases with gaping scleral wounds; with corneal wounds threatened with further injury by a large or irregular foreign body; cases in which extraction by the anterior

route was unsuccessful; and cases in which the foreign body was fixed in the wall of the posterior ocular segment. In spite of the large number of retinal detachments following posterior-route extractions, the visual results as a whole were not inferior to those of anterior route extractions. Most cases of retinal detachment occurred in eyes in which the foreign body had remained a long time and had become encapsulated. Since the introduction of prophylactic diathermy-coagulation, retinal detachment has occurred in only one eye, in which the foreign body had stayed for five months and was attached to the retina.

Ray K. Daily.

Kirwan, E. O'G., and Sen Gupta, M. **Localization and removal of magnetic intraocular foreign bodies.** *Indian Med. Gazette*, 1943, v. 78, Nov., pp. 530-532.

In the Eye Infirmary of the Calcutta Medical College, cases of eye injury are X rayed after placing a contact lens on the cornea, so that the location of the foreign body can be judged in relation to the position of the contact lens. A Zeiss contact lens is said to cast a very good shadow on an X-ray film. The contact lenses of greater corneal height show most distinctly. A lateral view is taken with the contact lens in place, and an anteroposterior view with the patient lying on his face, with nose and chin touching the X-ray table, the usual precaution being taken to eliminate as far as possible the shadow of the petrous portion of the temporal bone. The anteroposterior view should not be taken with the contact lens in place, because of the possibility that the shadow of the contact lens may overlap that of the foreign body. The authors give seven illustrative cases. (One diagram

in text, a plate containing 12 reproductions of X-ray films, references.)

W. H. Crisp.

Kochkonogov, M. I. **Injury of the orbit with indelible pencil.** *Viestnik Oft.*, 1942, v. 20, pts. 1-2, p. 63.

To 11 cases reported in the literature the author adds one. A man 41 years old fell, and was struck in the left eyelid by an indelible pencil protruding from the pocket of a bystander. The lid became swollen and a bluish secretion exuded from the wound. On opening the wound a piece of indelible pencil 4 mm. long was found. It was removed and the tissues around it excised. The patient made an uneventful recovery. Unless the pencil with the stained tissue is promptly removed, the aniline dye sets up an aseptic necrosis of the tissues, which results in chronic inflammation with encapsulation and cyst formation, so as to require repeated surgery and to leave disfiguring scars.

Ray K. Daily.

Lijó Pavia, J., and Lachman, R. **Hole in macula due to trauma from light.** *Rev. Oto.-Neuro.-Oft.*, 1943, v. 18, July-Aug., pp. 107-116.

The authors give indisputable proof that the retina, especially the macular and paramacular areas, is sensitive to trauma from excessive light. The retinal alterations following this type of trauma may be simply functional without fundus lesions, functional with slight transitory fundus changes, or grave with permanent changes as in the authors' two cases of exposure to a solar eclipse. After studying these two cases over a period of two years, they conclude that visual disturbances follow immediately after exposure and affect the fixation center, that fundus changes are not constant and may re-



cede, that Jess's typical annular scotoma is not always present, that peripheral vision may be lost, and that macular degeneration occurs. The most significant finding in the two cases here recorded was respectively a small hole in the right macula of one patient and in the left macula of the other, due to similar exposures to a solar eclipse without ocular protection, some years previous to examination.

Edward Saskin.

Neglo, L. G., and Spector, I. Z. A case of air embolism in a fracture of the orbit. *Viestnik Oft.*, 1942, v. 20, pts. 1-2, p. 60.

A ten-year-old boy was struck in the left eye with a stick, and died in the hospital two days later of cardiac failure. The autopsy revealed fractures of the superior orbital wall and of the lamina cribrosa, and cardiac air-embolism.

Norris, S. W. K. A wasp sting. *Brit. Jour. Ophth.*, 1944, v. 28, March, p. 139.

The case of a patient presenting symptoms of epiphora, pain, and photophobia in the right eye, of seven weeks duration, is reported. He had previously been treated in three different hospitals for keratoconjunctivitis. Vertical striae, faintly staining, were present over the upper third of the cornea. A subtarsal foreign body was looked for, but all that could be seen was a small papule with a brownish center. The skin of the upper lid was normal. An attempt to remove the brown spot was made, although three different ophthalmologists elsewhere had made five unsuccessful efforts to do this. Nothing was found, but the next morning a fine hair-like structure was seen and removed from the center of the papule.

The patient then gave a history of having been stung on the right eyelid by a wasp. He had refrained from mentioning this fact earlier, because his story had not been believed in the other hospitals. Upon examination by an entomologist, the hair was reported to be "the distal part of the lancet of the sting of a wasp."

The next day after removal of the sting, the patient was symptom-free, with vision of 6/6 in each eye.

Edna M. Reynolds.

Schench, H. P., Silcos, L. E., and Godfrey, E. W. Eye casualties treated on a hospital ship. *United States Naval Med. Bull.*, 1944, v. 42, April, pp. 802-821.

In this survey of 3,019 patients, 38 percent were admitted for injuries directly due to combat. 451, or 15 percent, sustained eye injuries of varying severity. The majority were admitted 6 to 8 days after injury and remained on ship board from 36 hours to 8 days. 80 percent of the eye casualties also had other wounds. Injuries to the eyelids were very frequent, burns occurring in 212 patients, almost all being flash burns. The most satisfactory primary treatment consisted of thorough cleansing with soap and water and removal of crusts, debris, and necrotic material. Wet compresses of saturated boric-acid solution were then used continuously and microcrystalline sulfathiazole powder was applied several times daily. Daily conjunctival irrigation was followed by 2-percent butyn ointment with metaphen or merthiolate. Early Thiersch grafts were used when advisable. Unfortunate sequelae of lid wounds may be minimized by prompt repair based on sound anatomic principles. Repair of the orbicularis muscle is essential for good cos-

metic result. The following procedures are important: (1) intermarginal sutures, (2) closure of conjunctival wounds to prevent adhesions to the globe, (3) additional sutures near the cilia to prevent notch formation, (4) accurate approximation of skin edges. Corneal burns occurred in but 27 of the 212 lid-burn cases. Shrapnel fragments were responsible for most of the corneal injuries. In extensive corneal lacerations human hair was used for suture material. In concussion injuries it must be remembered that the critical distance of high explosive is four times as great under water as in the air. The commonest findings in blast injuries are conjunctival hemorrhage, photophobia, and night blindness. In compression injuries paracentesis was of no value. The lacerated globe is usually less apt to suppurate than the shattered globe, which fact may have a bearing on sympathetic ophthalmia. All of the patients with penetrating wounds received tetanus toxoid, sulfonamides by mouth, and, when indicated, intravenous typhoid-vaccine. 136, or 30 percent, of the eye casualties had foreign bodies in the eyeball or adnexa. Of these at least one half were magnetic. In their localization opaque corneal and scleral markers or clips fixed to the lids were employed. Non-perforating foreign bodies were removed under the biomicroscope with a Ziegler knife. Sclerotomy incisions were rimmed with diathermy needles to prevent later retinal detachment. Injuries to the bony orbit were noted in 14 patients, all of whom had edema or hemorrhage in the orbital tissue. Sulfonamide therapy was considered an important adjunct. Lid suture was frequently employed. Local anesthesia was generally employed. Intravenous

sodium-pentothal was almost exclusively used as a general anesthetic.

Charles A. Bahn.

Schorstein, J. Compound fronto-orbital fractures. *Brit. Jour. Surg.*, 1944, v. 31, Jan., p. 221.

The author describes eight cases of compound fronto-orbital fracture and the operative technique he used. In all cases the dura had been torn. In some cases the frontal sinuses were fractured, in others the roof of the orbit was fractured, and in a third group the fracture extended into the ethmoidal cells. In six cases in which an early and radical wound débridement was carried out the results were satisfactory. Two patients who came under the author's care ten days and five months respectively after the injury, and whose wounds received only superficial attention at other hospitals, had delayed recovery complicated by intracranial sepsis. R. Grunfeld.

Scobee, R. G., and Griffey, E. W. Actinic keratoconjunctivitis. *Amer. Jour. Ophth.*, 1944, v. 27, June, pp. 632-635. (References.)

Slaughter, H., and Alvis, B. Y. Pneumo-encephalocele secondary to a puncture wound of the lid. *Amer. Jour. Ophth.*, 1944, v. 27, June, pp. 617-620. (2 illustrations, references.)

Snow, J. S., and Harley, R. D. Dermatitis venenata and keratoconjunctivitis caused by the manzanillo tree. *Arch. Derm. and Syph.*, 1944, v. 49, April, p. 236.

Eighteen patients with dermatitis venenata resulting from contact with the manzanillo (beach apple) tree, which is common along the shores of the Caribbean, were used as subjects

for a study of this type of dermatitis. The dermatitis resembles that produced by other toxic plants, although the onset is rapid. Areas most frequently involved were the face, the forearms, the upper part of the trunk, and the genitalia. Four patients presented a severe keratoconjunctivitis with temporary "blindness" produced by blepharospasm and by denudation of the corneal epithelium.

Treatment of dermatitis consisted of wet dressings and soothing applications. The ocular lesions responded to instillation of anesthetics for relief of pain, and irrigations with isotonic solution of sodium chloride. Patch tests indicated that the sap of the tree was the chief irritating substance. To remove the sap and thus prevent the cutaneous reaction, tests showed that ether, soap and water, and sea water were effective in the order named. Recommended effective prophylactic measures are: (1) prompt immersion in sea water, preferably with eyes open; (2) thorough washing of the entire body with soap and water.

Theodore M. Shapira.

Stallard, H. B. War surgery of the eye. *Brit. Jour. Ophth.*, 1944, v. 28, March, pp. 105-135.

Stallard reviews 102 cases of penetrating wounds of the eye with retained intraocular foreign body which were treated at a general hospital serving the Eighth Army in its North African campaign from November, 1941, to May, 1943.

Forty-nine of the wounds were from battle casualties suffered during direct contact with the enemy. Of these, 11 were battle-casualty accidents due to such causes as explosion of booby traps, mines, and hidden hand gre-

nades; 17 were civil accident cases, occurring in men engaged in the repair of vehicles, where such implements as hammer and chisel were used; 25 were due to stupid accidents such as inexperienced dismantling of hand grenades, fuses, and mines, or tossing hand grenades in play.

Of the penetrating wounds, 56 were through the cornea, 42 through the sclera, 3 through both the cornea and sclera, and in 9 cases the site of penetration was not seen. Prolapse of the uveal tract through a penetrating wound occurred in 29 cases, traumatic cataract in 50, vitreous hemorrhage in 49, vitreous prolapse in 5, and retinal detachment in 2 cases. In this series, 58 soldiers had wounds in other parts of the body.

The intraocular foreign body was localized by the ophthalmoscope in 17 cases. In 7 of these cases the foreign body was extracted by the posterior route (through the sclera). The other 10 foreign bodies, which were non-magnetic, were not removed, since they showed no evidence of adjacent inflammation. X-ray localization was made in 38 cases. A simple method of X-ray localization with a silver ring stitched to the corneo-scleral junction is described.

Because of the fact that war-missile foreign bodies are so slightly magnetic, extraction through a scleral incision is the method of choice when the foreign bodies are situated behind the lens. The technique of removal by the posterior route is given in detail, with three illustrations. In 73 of the cases here reported, removal by the posterior route was tried; in 32, the anterior route.

Vision was improved in 23 cases, in 47 cases there was no improvement in

vision but all have kept the injured eye to date. Evisceration was done in 7 and enucleation in 13 cases, 7 because of shrinkage and 6 because of the danger of sympathetic ophthalmia. It was impossible to assess the value of treatment with drugs of the sulfonamide group. Generally it was not until patients had reached the hospital that regular sulfonamide therapy could be given. (9 figures, tables.)

Edna M. Reynolds.

## 17

### SYSTEMIC DISEASES AND PARASITES

Farias, Natalicio de. The importance of nutrition in disturbances of the visual apparatus in schoolchildren. *Rev. Brasileira de Oft.*, 1943, v. 2, Dec., pp. 95-99.

The author discusses the importance and food value of various articles of diet.

Ferreira, J. A., and Austregesilò, Jr. Syndrome of Claude Bernard Horner. *Rev. Brasileira de Oft.*, 1943, v. 2, Sept., pp. 39-40. (See Section 13, Eyeball and orbit.)

Hansel, F. K. Allergy in otolaryngology and ophthalmology. *Laryngoscope*, 1942, v. 52, March, p. 242.

A short review of ocular allergy indicates satisfactory control of 50 percent of 30 consecutive cases of allergic conjunctivitis by means of desensitization and eliminative measures. Unilateral allergic cataract may occur in 50 percent of cases, and in all reported by Beetham a long-standing eczema was present. Owen C. Dickson.

Reisner, D. Boeck's sarcoid and systemic sarcoidosis (Besnier-Boeck-Schaumann disease). *Amer. Review Tuberculosis*, 1944, v. 49, May, p. 437.

A study of 35 cases of sarcoidosis is presented, dealing mainly with clinical observations. The majority of the cases were in Negroes, confirming the observation that in the United States the disease occurs with greater frequency in Negroes than in white persons. Sarcoidosis is inherently a widespread systemic affection with predilection for certain organs or anatomic systems. The prognosis of sarcoidosis depends in a large measure on the extent of permanent and irreparable functional damage resulting from localization of the lesions in special organs, particularly the lungs, heart, and eyes.

The eyes and their adnexa are found to be implicated in a considerable proportion of the cases. In this study about one fourth of the group, or nine cases, had ocular manifestations. Practically every part of the eye or its adjacent structures may become involved in the course of the disease.

Among the nine cases here reported, iridocyclitis was found in five, two showed only corneal and conjunctival changes, and in two enlargement of the lacrimal glands was present without change in the eye itself. Involvement is generally bilateral, though in occasional cases the lesion may be unilateral. The fate of the lesions affecting the eye, especially in the uveal tract, is apparently quite variable. While a number of cases with iridocyclitis show complete and apparently spontaneous healing with restitution to normal, in a good many others permanent damage may cause marked functional impairment, not infrequently resulting in blindness. The cases in which the lesion appeared to be limited to the conjunctiva and cornea, as well as those with involvement of the lacrimal glands, showed com-

plete regression during follow-up observation. Theodore M. Shapira.

Scott, J. G. Ocular syndrome in onchocerciasis. *Brit. Med. Jour.*, 1944, April 22, p. 553.

*Onchocerca volvulus*, the blinding filaria, is endemic in certain parts of West Africa and America. In two cases of this infestation, reported in detail, (1) edema of the upper lid, (2) proptosis, (3) ciliary flush, and (4) edema of the optic nerve occurred as unilateral phenomena. Vision was reduced markedly by the neuritis, but returned to normal in 30 days in one case, in 60 days in the other. Hemorrhages and exudate were seen in the fundus, and microfilariae could be seen floating in the anterior chamber, of the second patient. Many microfilariae were found by skin biopsy in each case.

The syndrome of upper-lid edema, proptosis, ciliary flush, and optic-nerve edema might also be caused by hemorrhage, tumor, infection as from orbital cellulitis, or congestion due to venous or lymphatic stasis. These conditions must be considered in differential diagnosis. The authors think the cause of the syndrome is not lymphatic stasis, but anaphylactic edema caused by *Onchocerca volvulus*.

Robert N. Shaffer.

Sorsby, Arnold. Tuberculosis and the eye. *The Practitioner*, 1944, v. 152, Feb., pp. 79-81.

Frank tuberculosis of the eye is relatively rare. The major significance of tuberculosis in ophthalmology centers around numerous ocular affections for which a tuberculous etiology is assumed on grounds not always beyond criticism. Of these, phlyctenulosis is the most frequent, 80 per cent of such cases having a tuberculous back-

ground. It is an allergic reaction. Of 592 children and adolescents with phlyctenulosis, 84 percent were Mantoux-positive as compared with 15 percent in a control series of 900 children with blepharitis. The author believes that phlyctenulosis is essentially the manifestation of a tuberculous infection plus added debility from malnutrition, vitamin-A deficiency, intercurrent disease, and poor hygiene, which create or increase allergy. Similarly, the uveal tract may be involved in nonspecific allergic reactions manifested as chronic inflammation, especially of the iris and ciliary body. Somewhat similar, but more rare, are sarcoidosis and Heerfordt's syndrome. Charles A. Bahn.

## 18

### HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Ade, C. H. Ocular problems of war workers. *Jour. Indiana State Med. Assoc.*, 1944, v. 37, March, p. 96.

Employers and employees are concerned with three major groups of problems in industry. In the first group belong visual errors and job classification, including jobs where danger is of maximum importance, jobs where efficiency is paramount, and jobs where neither special ability nor special safety measures are required. In some special jobs color sensitivity is of importance, and in others accurate depth perception (as in the selection of crane operators). In the second group belong the infectious diseases of the eye. The problem here is prevention of an epidemic. In the third group belong injuries, chiefly by foreign bodies and chemical burns. The industrial physician should have enough special training to recognize and to differentiate potentially serious conditions and to know which of them need the care of

an ophthalmologist. When no physician is present the first-aid worker should possess definite criteria as to prompt and adequate treatment of emergency cases. R. Grunfeld.

Bane, W. M. The treatment of eye diseases by the general practitioner. *The Journal-Lancet*, 1944, v. 64, March, p. 77.

The author gives an exhaustive description of modern treatment of eye diseases including vitamin therapy. The article is written primarily for the general practitioner but is of interest for the ophthalmologist.

R. Grunfeld.

Bell, G. H. Visual physiology of the cinema. *Brit. Med. Jour.*, 1943, Nov. 27, pp. 669-671.

In 1941 the Society of Motion Picture Engineering issued a series of recommendations, including the use of a 16-mm. projector as standard for educational purpose. The writer goes into technicalities regarding the sitting distance of the spectator from the film either frontally or laterally, and the position and brightness of the lights. The image projected on a flat screen gives a feeling of depth by variations in size of objects and in light intensity in perspective and parallax. (References, 2 figures.) M. Lombardo.

Burnett, M. C. Study of blind students in schools of social work. *Outlook for the Blind*, 1944, v. 38, April, p. 91.

Brief questionnaires were submitted to the 42 schools in the American Association of Schools of Social Work. At least 19 of these had admitted blind students. The total number of blind pupils involved was 57. The questionnaire was too limited to permit ac-

curate conclusions as to students' success, which seemed to vary with the school involved as well as with the personality and ability of the individual pupil. Most of the schools felt that the blind could function satisfactorily in social work. Though most schools attempted to place them in agencies for the blind, some students have done well in various forms of social work. The author thinks students should be given the responsibility of managing their training and should later be recommended for positions in accordance with their school success, just as are seeing pupils. Robert N. Shaffer.

Campos, Edilberto. Hilario de Gouvêa, ophthalmologist. *Rev. Brasileira de Oft.*, 1943, v. 2, Dec., pp. 63-67. (See also next abstract.)

The Brazilian National Academy of Medicine recently celebrated the centenary of the birth of de Gouvêa, who in 1881, in Rio de Janeiro, was the first Brazilian professor of ophthalmology as distinct from general medicine and surgery. At that time every Brazilian ophthalmologist had obtained his training in Europe, there being no teaching of ophthalmology in Brazil. De Gouvêa associated the practice of otolaryngology with that of ophthalmology. W. H. Crisp.

Farias, Natalicio de. Professor Hilario de Gouvêa. *Rev. Brasileira de Oft.*, 1943, v. 2, Dec., pp. 81-84. (See also preceding abstract.)

At the age of 68 years, de Gouvêa (born 1823) promoted educational reform in the School of Medicine of Rio de Janeiro, where he had become Professor of Ophthalmology at the age of forty years. He had received his education in the medical schools of Brazil, France, and Germany. During

political exile in France, at the age of fifty years, he specialized in otolaryngology, and at 68 years of age he was made Professor of this subject at Rio de Janeiro. Hilario de Gouvea died in 1923 of diabetes, after amputation of the lower limb at the thigh.

W. H. Crisp.

Hayes, S. P. Arithmetic teaching and testing in schools for the blind. *Outlook for the Blind*, 1944, v. 38, April, p. 92.

The author states that social utility rather than mental discipline should be the aim in teaching arithmetic to blind pupils, and hence that greater stress on mental arithmetic is indicated rather than drills in fractions, long columns for addition, and so on. He suggests learning the multiplication table up to the square of 25, and thorough knowledge of factoring, cancellation, and the like. In tests of arithmetical problems included in the Stanford Achievement Series the blind pupils ranked close to the curve of the seeing pupils. In arithmetical computation, however, most of the blind are one to three years below normal. This is because the test is loaded with calculations which can not be solved mentally. Various methods of stimulating interest in number work and of improving performance are given. Tests adapted to the blind are discussed. Robert N. Shaffer.

Karpinos, B. D. Visual acuity of selectees and Army inductees. *Human Biology*, 1944, v. 16, Feb., pp. 1-14.

This is a tabulated analysis of the visual acuity of several groups of 1,000 individuals each, taken at random from the examination records of 23,706 selectees and inductees examined at an induction center. In the white group of 1,000, aged 18 to 24 years, 624 had vi-

sion of 20/20 in each eye, but in the white group 25 years and over, only 596 had the same vision in each eye. In the colored group, the numbers were respectively 620 and 571. Of the white selectees of all ages, 59.4 percent had vision of 20/20 in each eye, 83.4 percent 20/40 or better, 87.8 percent 20/70 or better, and 95.9 percent 20/20 or better in each eye. In the first tables, the visual acuities of right and left eyes of 1,000 white selectees are analyzed into ages 18 to 24 years, 25 and over, and all ages. The second table similarly analyzes colored selectees. The third and fourth similarly analyze those of white and colored inductees. Table five deals with the number of specific visions in white and colored groups. Graphs 1, 2, and 3 deal with monocular and binocular specific visions in white and colored selectees and inductees in the three age groups mentioned.

Charles A. Bahn.

Mann, I., and Archibald, C. A study of a selected group of women employed on extremely fine work. *Brit. Med. Jour.*, 1944, March 18, p. 387.

Twenty-eight factory workers employed in the inspection of extremely fine spiral filaments were examined with a view to determining the ocular and psychologic factors involved in successful performance of tasks involving accurate vision. The main factors in order of importance are: (1) binocular balance, (2) refraction, (3) psychologic stability. The few ocular complaints in this group came from persons with phorias rather than with high refractive errors. The person applying for exacting jobs involving continuous use of the eyes should be orthophoric on the wing test, should have no hyperphoria, and should have well-developed stereopsis and a corrected visual acuity



of 6/6. Failing this, the subject should be monocular for near vision. Though certain neurotics can make satisfactory adjustment, particularly some anxiety, compulsion, and obsession cases, in general the safest group are good average people not so unduly blessed with imagination or intelligence as to make them dissatisfied with repetitive factory work. Robert N. Shaffer.

Silva, Linneu. Rational concept of the teaching of clinical ophthalmology in our medical faculties. *Rev. Brasileira de Oft.*, 1942, v. 1, Dec., pp. 71-81.

This is an inaugural lecture at the Course of Clinical Ophthalmology in the Department of Medical Sciences of Rio de Janeiro. The author emphasizes the well-known facilities of direct examination of the eye and its diseases, as contrasted with more obscure approach to other parts of the body; and deals with the significance of this situation for general diagnosis, particularly vascular and neurologic. He suggests that the teaching of ophthalmology to undergraduate students ought to deal chiefly with those aspects of ophthalmology which do not require elaborate instrumentation, or which have importance for general diagnosis, or which require urgent attention in those areas where special practitioners are not available. A neglected factor in medical teaching is the understanding of educational methods. Teachers in medical schools ought to avoid excessively technical presentation of their subjects, and should aim at clarity and simplicity. W. H. Crisp.

Stinchfield-Hawk, Sara. Speech training in a nursery school for visually handicapped children. *Outlook for the Blind*, 1944, v. 38, Feb., p. 39.

Visually handicapped children are

notably retarded in their early efforts at speech because of their inability to imitate from visual forms. Two nursery schools, one in Los Angeles and the other in Boston, are using the notokinesthetic method of speech training, with favorable results as shown by personality development and increase in mental development as measured by several of the standard mental tests.

The method consists of association of sounds with various toys or objects by means of tactile and motor activity. This is done as a game. For instance, the sounds "h," "f," "t," may be learned from a toy horse with feet and tail and so forth. The age range in the training group in Los Angeles is from 18 months to six years.

Owen C. Dickson.

Strong, Austin. I learned what it means to be blind. *Saturday Evening Post*, 1944, April 29, p. 24.

In an interesting and sympathetically written article this noted author tells of his experiences at the Seeing-Eye School. For four weeks he was given the basic training taken by every blind student and tried out all the techniques blindfolded, including a nerve-racking expedition through heavy traffic guided by a Seeing-Eye dog. He passes on to the reader some understanding of what a dog must mean to those in darkness when they find their lives can be trusted with perfect confidence to a new pair of vigilant eyes and ears. Robert N. Shaffer.

Vidal, Joaquim. Some considerations about ocular hygiene in students. *Rev. Brasileira de Oft.*, 1942, v. 1, Dec., pp. 83-98.

This reproduces a radio broadcast to the public during the first Inter-American Congress for Prevention of Blindness, and is one of a series of

such addresses organized by the Brazilian Secretariat of Education and Health. Particular attention is given to hygienic rules as to reading, and to the causes of direct injury to the eyes during school life. W. H. Crisp.

Vila Ortiz. The price of negligence in industrial traumatology. *Arch. de Oft. de Buenos Aires*, 1942, v. 17, Sept., p. 595.

The author emphasizes the importance of protective ocular appliances in the prevention of industrial hazards, and discusses the sums actually saved by use of such appliances in large plants, particularly in the United States of America. He argues that the hazards would be avoidable in one hundred percent of the cases if the use of protective goggles were compulsory, the expense of acquiring them being amply repaid by savings in claims and indemnities. (Bibliography.)

Plinio Montalván.

Wanamaker, P. Training program for teachers of the blind. *Outlook for the blind*, 1944, v. 38, April, p. 97.

The teachers at the Washington State School for the Blind are required to qualify for certification on the same basis as teachers in other state public schools. In addition they must qualify in specialized techniques such as ability to read and write Braille. Special certificates are issued in arts and crafts, music, and so on. Those who have been teaching over three years are urged to take refresher courses in the summers.

Robert N. Shaffer.

19

ANATOMY, EMBRYOLOGY, AND  
COMPARATIVE OPHTHALMOLOGY

Anfinsen, C. B. Distribution of cholinesterase in the bovine retina.

*Jour. Biol. Chem.*, 1944, v. 142, Feb., p. 267.

That chemical substances liberated at autonomic nerve endings may act as mediators of the nervous impulse is supported by a large body of evidence. The rapidity of conduction in nerve tissue suggests that if this is so, high concentrations of cholinesterase must be present at localized points in order to remove the mediator, acetylcholine. Gross distribution of cholinesterase in the central nervous system has been determined.

Retina ideally contains synaptic structures in reasonably isolated and compact form. Studies of cholinesterase activity of selected layers of bovine retina demonstrate the presence of concentration of cholinesterase for the most part in the synaptic layers as contrasted with the nuclear, rod, and nerve-fiber layers. Although this localization can be demonstrated, other factors are still necessary before accepting completely synaptic transmission in terms of the acetylcholine-cholinesterase system.

Owen C. Dickson.

Anfinsen, C. B. Distribution of diphosphopyridine nucleotide in the bovine retina. *Jour. Biol. Chem.*, 1944, v. 152, Feb., p. 279.

Diphosphopyridine nucleotide or D.P.N. is an essential component of oxidative and glycolytic systems in tissues, and is found in the retina in greater amounts than in other body tissues.

Because of the ease of obtaining relatively specific tissue layers in the bovine retina, a study was made to localize the site of highest concentration of D.P.N. in this structure.

Results indicate the highest values for the synaptic layers. Values for the

nerve-fiber layer and the inner nuclear layer are omitted because of technical difficulties.

It is well known that D.P.N. is a ubiquitous component of protoplasm, and in combination with specific enzymes serves to carry out certain dehydrogenations. It is logical to assume some correlation between tissue metabolic activity and concentration of D.P.N.

Since it is known that the formation of acetylcholine from pyruvate and choline is an oxidative process, the high concentration of D.P.N. in the same layers as cholinesterase suggests that this enzyme plays an important part in retinal synaptic transmission chemistry. .

Owen C. Dickson.

Crozier, W. J., and Wolf, E. Flicker response contours for the sparrow, and the theory of the avian pecten. *Jour. Gen. Physiology*, 1944, v. 27, March, p. 315.

The flicker contour of the house sparrow (*Passer domesticus*) is duplex—rod and cone contour. The presence of the pecten brings about changes in the "cone" part of the contour when the light time in the flash cycle is varied. The changes are the same as found in the visually simple zebra finch, and for man when provided with a grid shadow, an "artificial pecten." The rod curve is not influenced by the presence of the pecten.

R. Grunfeld.

Crozier, W. J., and Wolf, E. Theory and measurement of visual mechanisms. 10. Modifications of the flicker-response contour, and the significance of the avian pecten. *Jour. Gen. Physiology*, 1944, v. 27, March, p. 287.

When there is projected on the retina of man, monocularly, the shadow

of a grid which divides the visual field into several distinct areas, not including the fovea, the ordinary properties of the flicker-recognition contour as a function of light-time fraction become markedly disturbed. Upon illumination of separated retinal areas summation of excitations from these several areas occurs, although the total number of acting cone-units does not increase. If the light-time fraction increases to 0.75 and on up to 0.90, the slope of the cone curve becomes sharply increased and there is evidence of an increase in the number of acting cone units. The "rod" curve remains apparently unaffected by the grid shadow.

The changing form of flicker-recognition contour as a function of light-time fraction, produced in man when the illuminated field is divided into parts by a shadow pattern, is normally found in the *Taeniopygia castenotis* (the zebra finch). The retina of this bird has only cones and has a large, complex, and darkly pigmented pecten, which casts a foliated shadow on the retina. The increase of flicker acuity due to the pecten shadow is considerable when the dark spaces are brief in relation to the light spaces. The effect of the avian pecten is probably to increase the sensory influence of small moving images. It is of theoretic importance that this may be brought about by an actual decrease of the total effective retinal area illuminated.

R. Grunfeld.

Evans, T. H. Nerve branch at superior orbital fissure connecting sixth cranial with component of sphenopalatine ganglion. *Amer. Jour. Ophth.*, 1944, v. 27, June, pp. 645-646.

Vidal, F., and Malbrán, J. L. The path of the inferior peripheral homo-

lateral fibers in the cat. Retinal microlesion. Arch. de Oft. de Buenos Aires, 1942, v. 17, Sept., p. 521.

Under ophthalmoscopic control and by means of Vogt's electrolytic needle the authors first produced a microlesion in the retina. The animal was killed 13 days later and the specimens were studied with the aid of the Swank-Davenport and the Coleman and Bell stains. The experiments show the efficacy of the method employed, since the small number of fibers in-

involved in the retinal microlesion permitted more thorough delimitation of the degenerated areas throughout the tract. They also prove that the inferior retinal fibers are situated along the inferior portion of the optic pathways, with the exception of its last part, where the fibers ascend to reach the dorsal geniculate body. Likewise, the peripheral temporal fibers of the retina run along the lateral aspect of the tract. (Photomicrographs, bibliography.)

Plinio Montalván.

# PAN-AMERICAN NOTES

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Communications should reach the Editor by the twelfth of the month

## MISCELLANEOUS

*Argentina.* The III Argentinian Congress of Ophthalmology is scheduled to be held in Cordoba during the second fortnight of October, 1944. The program is as follows:

### OFFICIAL SUBJECTS

I. *Plastic ocular surgery.* a) Palpebral and conjunctival autoplasties, by Prof. Dr. Jorge Malbrán; b) Autoplasty of the lacrimal pathways, by Dr. Horacio B. Moulié and Jorge Balza; c) Keratoplasties, by Dr. Ramón Castroviejo; d) Reparative surgery of the orbit. Operations to improve the socket after enucleation and evisceration. Reconstruction of the cavity after enucleation, by Dr. Carlos S. Damel.

II. *Ocular tuberculosis.* A. *General section.* a) History—Generalities—Etiology—Pathogeny, by Dr. Esteban Adrogué; b) Diagnosis (in general), by Prof. Dr. Rodolfo Laje Weskamp, and Dr. Dante J. Yadrola; c) Treatment (in general), by Prof. Dr. Juan M. Vila Ortiz, and Dr. J. López Bonilla (son).

B. *Special section.* a) Tuberculosis of the lids, lacrimal pathways, conjunctiva, cornea, sclera and orbit, by Drs. Baudilio Courtis and Gunther von Grolman; b) Tuberculosis of the uveal tract, retina, and optic nerve, by Dr. Miguel Ibañez Puiggari, Héctor R. Picoli, and Julio Tettamanti.

### OFFICIAL SUBJECTS TO BE PRESENTED BY NON-ARGENTINIAN, LATIN-AMERICAN MEMBERS

1) Occult ocular tuberculosis and tuberculin therapy, by Prof. Carlos Charlin C.; 2) Sulfonamides in ophthalmology, by Prof. Dr. Moacyr E. Alvaro; 3) Diseases of the optic nerve (study of ophthalmoscopic aspects), by Prof. Dr. Ivo Correa Meyer; 4) Trachoma in Paraguay, by Prof. Dr. Jorge Codas Thompson; 5) Sporotrichosis in ophthalmology, by Prof. Dr. Linneu Silva; 6) Ectopia of the lens, by Prof. Dr. Aniceto Solares; 7) Pulsating exophthalmos, by Prof. Dr. Alberto Vasquez Barriere.

*Brazil.* In order to give the first lecture of the year in the courses of ophthalmology of the Escola Paulista de Medicina, Prof. Jorge Malbrán, assistant professor of ophthalmology of the Faculdade de Medicina of the University of Buenos Aires, came to São Paulo in March, at the invitation of Prof. Moacyr E. Alvaro. Dr. Malbrán chose as his subject for this lesson, "Some therapeutic rules and principles in ophthalmology." Professor Malbrán, with his assistant, Dr. Flaminio Vidal, also gave a series of lectures on the "Optic pathways."

*Uruguay.* At the National Medical Congress held in Montevideo, March 17th, the following papers relating to ophthalmology were presented in the section on arterial hypertension: Prof. A. Vasquez Barriere, "Acute occlusions of the retinal vessels in cardiovascular diseases (presentation of retinographs)"; Prof. Moacyr E. Alvaro and Dr. Jairo Ramos, "Correlation

of arterial pressure with the visual function and its ophthalmoscopic picture."

*Postponement of the Pan-American Congress of Ophthalmology.* Due to the prevailing difficulties in transportation, the executive officers of the Pan-American Congress of Ophthalmology, in agreement with the local organizing committee in Montevideo, have decided to postpone the meeting until November, 1945, following the same program already published.

*Society for the Prevention of Blindness in Mexico.* This Society celebrated the twenty-fifth anniversary of its foundation in Mexico with a meeting called, "The scientific week." The proceedings of this meeting have just been published in a handsome volume containing 25 papers. The volume is well presented, and illustrated with photographs of the eyeground and some operations.

Among the papers presented, we notice one from Dr. A. Torres Estrada on the "Pathogeny of punctate keratitis in onchocercosis," and another by Dr. M. Puig Solanes, "A comparative study of diagnostic methods of incipient avitaminosis." Drs. W. H. Hoffman and P. Ramos Baez of Havana on "The blindness of leprosy can be prevented." Dr. L. Sanchez Bulnes on "Operative correction of spastic and senile entropion," and Dr. Manuel Marquez on, "Amblyopias and amaurosis of therapeutic origin."

Certain ophthalmologists of the United States contributed to the scientific program of the meeting. They were: Dr. William T. Davis, Dr. John N. Evans, Dr. Ramón Castroviejo, Dr. Arthur J. Bedell, Dr. Daniel B. Kirby, Dr. Ray K. Daily, Dr. Martin I. Green, and Dr. M. Uribe Troncoso.

There were also papers by Dr. Pacheco Luna of Guatemala and Prof. Moacyr A. Alvaro from São Paulo, Brazil. Dr. Martin I. Green, of San Francisco, and Dr. Dayne of Dallas, were present at the meetings.

## SOCIETIES

*Brazil.* The *Sociedade de Oftalmologia de Minas Geraes* has elected the following officers to serve during 1944-1945: president, Prof. Hilton Rocha; vice-president, Dr. Oswaldo Silveira; secretary, Dr. Ennio Coscarelli; treasurer, Dr. Antonio Isidoro.

The *Sociedade de Oftalmologia de São Paulo* has elected the following officers for the

period 1944-45: president, Prof. Moacyr E. Alvaro; vice-president, Dr. Antonio de Almeida; general secretary, Dr. Silvio de Almeida Toledo; secretary, Dr. Arthur Amaral Filho; treasurer, Dr. Aureliano Fonseca; and files, Dr. Paulo Braga Magalhães.

*The Sociedade de Oftalmologia e Otorrinolaringologia do Rio Grande do Sul* will be served by the following officers during 1944-46: president, Dr. Luis A. Osorio; vice-president, Dr. H. Lubisco; 1st secretary, Dr. Fernando Boges Alves; 2d secretary, Dr. Saul Fontoura; treasurer, Dr. Capt. Alfredo A. P. dos Santos; librarian, Dr. 1st Lieut. Antonio L. Viana.

## PERSONALS

Dr. Manoel A. da Silva who is at present studying in the United States as a holder of a Kellogg Foundation-Pan-American Congress of Ophthalmology Fellowship, read a paper on "Ophthalmology in Brazil," at the 52d annual meeting of the Chicago Ophthalmological Society, on April 17, 1944.

Dr. Daniel Silva of Mexico, D.F., older member of a Kellogg Foundation-Pan-American Congress of Ophthalmology Fellowship, who is at present studying in the United States, read a paper on "Ophthalmology in Mexico" at the 52d annual meeting of the Chicago Ophthalmological Society.

Dr. Augustin Perret of Caracas, holder of a Kellogg Foundation-Pan-American Fellowship and at present studying in the United States, read a paper on "Ophthalmology in Venezuela" at the 52d annual meeting of the Chicago Ophthalmological Society, held on April 17th.

In April, at the invitation of Prof. Moacyr E. Alvaro, Drs. Baudilio Courtis and Roberto Beltran Nuñez of Buenos Aires, Argentina,

came to São Paulo to give a series of lectures on Contact lenses. These lectures were well attended by Brazilian oculists who showed great interest in the subject.

## OBITUARY

Dr. Raphael Silva, a prominent ophthalmologist of Mexico City, died April 16, 1944, in the midst of his professional activities. He belonged to the generation of older ophthalmologists who created the Mexican Ophthalmological Society more than 50 years ago. Although not a founder, he was amongst the earliest members of the Society, and all his life worked for the development and success of the institution.

He studied in Europe, especially under the guidance of Professor Fuchs in Vienna and Professor Axenfeld in Freiburg. Later he became a collaborator of the *Klinische Monatsblätter für Augenheilkunde*.

He started the practice of ophthalmology by assisting the distinguished Mexican ophthalmic surgeon, Dr. Fernando Lopez, and soon became a noted surgeon himself. He was appointed to the staff of the Ophthalmic Hospital of Nuestra Señora de la Luz and, later on, became director of the Hospital, a place which he filled faithfully, and with great ability, until his death.

At the opening of the Escuela de Altos Estudios, in 1915, Dr. Silva became professor of ophthalmology, a post which he kept for several years.

During 1930-31, he was appointed director of the Health Department of Mexico, a position which he filled with ability.

He was recently appointed a member of the committee for awarding the Kellogg Foundation-Pan-American Congress of Ophthalmology fellowships. He belonged to the Mexican Academy of Medicine, to the French Ophthalmological Society, and others. His death is a great loss for ophthalmology in Mexico.

## NEWS ITEMS

Edited by DR. DONALD J. LYLE  
904 Carew Tower, Cincinnati 2

News items should reach the editor by the twelfth of the month

## DEATHS

Mr. Edward Bausch, Bausch and Lomb Optical Company, Rochester, New York, died July 30, 1944, aged 89 years.

Dr. E. D. Brooks, Kalamazoo, Michigan, died April 14, 1944, aged 89 years.

Dr. Julian H. Buff, Orlando, Florida, died May 10, 1944, aged 52 years.

Dr. Carl Fisher, Los Angeles, California, died June 7, 1944, aged 64 years.

Dr. Lee E. Grant, Detroit, Michigan, died May 31, 1944, aged 73 years.

Dr. Rudolph M. Gunderson, Lake Park, Minnesota, died April 2, 1944, aged 64 years.

Dr. Abell D. Hardin, Dallas, Texas, died May 10, 1944, aged 64 years.

Dr. W. A. Krieger, Poughkeepsie, New York, died May 19, 1944, aged 61 years.

Dr. Daniel J. O'Loughlin, Kankakee, Illinois, died May 8, 1944, aged 63 years.

Dr. Marion H. Powers, Weirton, West Virginia, died May 4, 1944, aged 62 years.

Dr. Paul J. Sartain, Philadelphia, Pennsylvania, died April 9, 1944, aged 82 years.

Dr. Harmon L. Stanton, Evansville, Indiana, died April 23, 1944, aged 50 years.

#### MISCELLANEOUS

At a recent meeting of the representatives of the professional and administrative services of the Office of the Surgeon General plans were discussed and progress reports made on the medical history of the war. Work on the history has been in progress since August, 1941, under the direction of Col. Albert G. Love of the Army Medical Department. Reports made at the meeting by officers responsible for historical volumes indicated that marked progress is being made in assembling information from medical installations in this country and overseas.

Editors have been selected for the volumes on the medical specialties and the administrative phases of the medical service. In addition to the research and editorial work to be done in the Office of the Surgeon General, historical activities will be carried forward by officers assigned to headquarters of overseas theaters. They will secure first-hand reports of the overall medical services particularly those rendered under combat conditions. Officers in overseas theaters who have had extensive experience with medical and surgical problems peculiar to this war are being asked to record their observations for the history.

#### SOCIETIES

The Southern Medical Association will hold its thirty-eighth annual meeting in Saint Louis, Monday through Thursday, November 12-16, 1944. For hotel accommodations address Hotel Committee, Southern Medical Association, Dr. Joseph C. Peden, chairman, 910 Syndicate Trust Building, Saint Louis 1, Missouri. The Section on Ophthalmology and Otolaryngology has as its chairman, Dr. W. Raymond McKenzie (Baltimore); as chairman-elect, Dr. J. W. Jervy, Jr. (Greenville, South Carolina); as vice-chairman, Dr. George J. Taquino (New

Orleans); as secretary, Dr. Elbyrne G. Gill (Roanoke, Virginia).

According to a recent announcement the Chicago Ophthalmological Society is planning a memorial in honor of the late Dr. Sanford R. Gifford in the form of a lecture on an ophthalmologic subject to be delivered annually before the Society. It is hoped that the many friends of Dr. Gifford will take this opportunity to contribute to this lecture fund in honor of the memory of one who made such outstanding contributions to ophthalmology. Contributions may be sent to the secretary of the Chicago Ophthalmological Society, Dr. William A. Mann, 30 North Michigan Avenue, Chicago.

The American Association of Eye, Ear, Nose, and Throat Society Secretaries will meet in Chicago during the Academy convention in October. Among the important subjects to be discussed is "Extension study courses for eye, ear, nose, and throat societies."

The Colorado Ophthalmological Society held the first annual Edward Jackson Memorial Lecture on June 22, 1944. The guest speaker was Dr. A. J. Bedell of Albany, New York. The subject of his address was "Ophthalmoscopy in the diagnosis of human illness." From his many pictures of the fundus he selected those to demonstrate the interesting but less-common observations in certain diseases. The lecture will be published in this Journal.

#### PERSONALS

Dr. Delbert K. Judd announces the opening of his office at Suite 423, Arcade Building, Kankakee, Illinois. His practice is limited to eye, ear, nose, and throat; bronchoscopy; and plastic surgery.

Dr. Frederick L. Wicks, Valley City, North Dakota, the founder and first secretary of the North Dakota Academy of Ophthalmology and Otolaryngology has resigned as secretary. Dr. Wicks had served for 25 years in that position.

Drs. Charles A. Hargitt, Edwin C. Place, and Michael J. Buonaguro were recently appointed assistant clinical professors in the Department of Ophthalmology, Long Island College of Medicine, Brooklyn.



EFFECT OF CHEMOTHERAPEUTIC AGENTS ON CELL DIVISION  
AND HEALING OF CORNEAL BURNS AND ABRASIONS  
IN THE RAT\*

GEORGE K. SMELSER, PH.D., AND V. OZANICS, M.S.

*New York 32*

Within recent years the local application of chemotherapeutic agents to the eye has become of the greatest practical value.<sup>1-6</sup> Although the effect of such compounds upon various strains of infecting organisms has been intensively investigated, their attendant influence on cell division of intact and injured ocular epithelia has received but little attention. The ideal chemotherapeutic agent should not interfere with the reproduction of healthy epithelial cells nor with the migration of these cells over a denuded area following an injury. Since sulfonamide drugs vary in their action on different bacterial strains, it seemed plausible that similar differences might exist in their effect on these fundamental activities of epithelial cells. Should this be true, the least toxic, yet effective, compounds should be chosen for local application to the eye. Studies were therefore initiated on the effect of these sulfonamides and penicillin on the rate of cell division in the intact cornea and in regenerating corneal epithelia following thermal burns and abrasions.

The healing of corneal wounds in the

past has usually been studied by staining the cornea with fluorescein and determining the time required for the stainable area to disappear. This procedure gives a summation of the healing processes in which both cell migration and cell division play a part. In the present study it was desired to separate these two factors, and the method used was to count the cells in mitosis in treated and control eyes at a standard time after initiating treatment or injury. The effect of the compounds studied on cell migration following corneal damage, of secondary importance in these experiments, was estimated by measuring the width of the defect in the corneal epithelium which remained 12 hours after injury.

Past work on this subject has been largely confined to corneal abrasions inflicted by a variety of methods. The epithelium has been removed by a knife or trephine,<sup>7,8</sup> spatula,<sup>9</sup> dental drill,<sup>10</sup> or with a dry swab following cocaine instillation.<sup>11</sup> Usually in these experiments the size of the defect was observed by staining with fluorescein.

## METHODS AND MATERIALS

The present studies were conducted on male, Sherman strain rats 60-100 gm. in weight. In all cases one eye was treated while the other served as either an intact control or a control that has been operated on. Therefore the effect of each experiment on the number of mitotic

\*From the Department of Ophthalmology, College of Physicians and Surgeons, Columbia University. Read at the fourteenth scientific meeting of the Association for Research in Ophthalmology, at Chicago, June 13, 1944. The work described in this paper was done under a contract, recommended by the Committee on Medical Research, between the Office of Scientific Research and Development and Columbia University.

figures was expressed as percentage increase or decrease relative to the control eye of the same animal. When comparisons were desired of the effect of different compounds on cell division, litter-mate animals were used.

Great care was taken to create standard burns and abrasions. The latter were in the form of a horizontal band 1 mm. in width and extending from limbus to limbus. This covered approximately one third of the corneal area. The abrasions were made, with the rat under nembutal anesthesia, by lightly outlining the abrasion area with a double bladed corneal knife and staining with 0.5-percent neutral fluorescein. The epithelium lying between the two marks was gently removed with a small, wedge-shaped, wooden applicator stick. Very little damage was done to the underlying connective tissue, none of which was removed. Sections of these abrasions showed that the epithelium was removed completely.

The thermal burns were made with a Shahan thermophore equipped with a terminal 1.5 mm. wide, and curved to fit the rat's cornea perfectly across its entire width. The thermophore, heated to 71°C., was applied for five seconds, producing a burn similar in shape to the abrasions described above. The edges of the injury, however, were probably not so sharply delineated as were those of the abrasions, for there must have been a peripheral radiation of heat from the instrument.

The sulfonamides were applied as fine powders or as 5-percent ointments in a lanolin base, and the penicillin in an aqueous solution (pH 6.5-7.0) containing 500 Oxford units (O.U.) per cubic centimeter.\* The powders were dusted on the

eye evenly over the entire cornea every two hours. In the experiment on intact corneas four or five applications were made. Five applications were made to the injured eyes, the first approximately two hours after the injury, and the last, two hours before autopsy. The regeneration experiments were always conducted for 12 hours, because it was found that epithelization of both burns and abrasions was frequently almost completed within that period.

The ointments were prepared by mixing three parts anhydrous lanolin with one part of a 20-percent solution of sodium salt of the sulfonamide. A control ointment base of petrolatum and one of lanolin prepared with an 11-percent sodium-chloride solution were also used. In addition to these, several sulfonamide ointments prepared in the pharmacy were tested. The ointments and penicillin solutions were applied hourly in all experiments. The penicillin-treated animals were held for two minutes after each application so that they were really subject to a corneal bath of the solution for two minutes each hour. An effort was made to apply an equal amount of powder or ointment each time; however, the total amount that was actually effective was unknown. After the first treatments a residuum of the earlier applications was noticeable.

At autopsy the rats were killed by decapitation, and the eyes and lids fixed in Bouin's fluid. The control and experimental eyes, one of which was stained *in toto* with eosin, were embedded together in a single block and eight-micra serial sections cut. Each section passed vertically through the upper and lower lids and corneas of both eyes. Such sections necessarily passed through the band-shaped injuries at right angles to their long axes. Fifteen of these paired sections taken at regular intervals through all parts of the cornea were studied. The

\* The penicillin used was released by Dr. C. S. Keefer and obtained through the kindness of Dr. Frank L. Meleney. Na penicillin, Pfizer 2.92 mg./1,000 O.U.; and Lederle 2.94/1000 O.U.; Ca penicillin, Squibb 12.5 mg./1,000 O.U.

slides were labeled in code so that the treatment was unknown when examined and the results, therefore, unbiased. Each difference was subjected to statistical analysis. The number of mitoses in the two eyes of 10 normal rats were counted. The difference

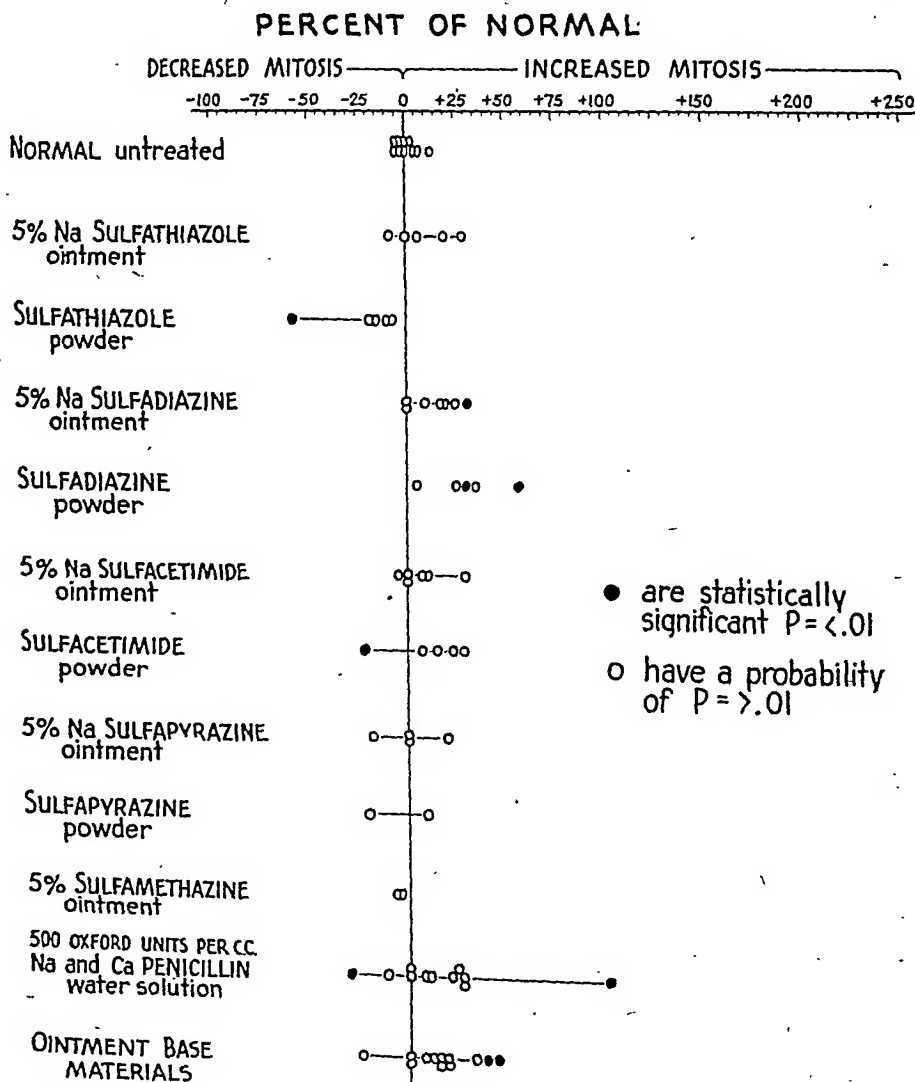


Fig. 1 (Smelser and Ozanics). The effect of sulfonamides, penicillin, and ointment bases on mitosis of the intact corneal epithelium.

analysis and the probability ( $P$ ) that it was due to random sampling determined.\*

These experiments rest upon the assumption that the number of mitotic fig-

\* The value,  $P$ , expresses the probability that the difference, expressed in percentage, is due to random sampling. Although a probability of 0.05 is frequently accepted as a criterion of significance, a more rigorous criterion—that is,  $p < 0.01$  (less than one chance in 100 that random sampling is responsible for the difference)—was used here.

between them, which averaged about 5 percent, was entirely insignificant (fig. 1).

#### I. EXPERIMENTS ON THE INTACT CORNEA

The effect of penicillin, sulfacetimide,† sulfadiazine, sulfathiazole, sulfapyrazine, and sulfamethazine on cell division in the

† We are indebted to Dr. E. Henderson and Schering and Company for the generous supply of sulfacetimide used in these experiments.

intact corneal epithelium was studied as afore-given. Most emphasis was placed on the first 4 drugs. The results are incorporated in charts which show the percentage increase or decrease in mitosis caused by these applications. Figure 1 shows that most of the sulfonamides had no deleterious effect on the cell-division rate in the intact cornea regardless of

gave no evidence of either inhibiting or stimulating mitosis; two cases were obtained which appeared to show opposite effects, but they were treated with different preparations. In both instances in which a depression in mitosis was obtained, treatment had been with the same preparation, a sodium salt. However, a second group of three animals treated

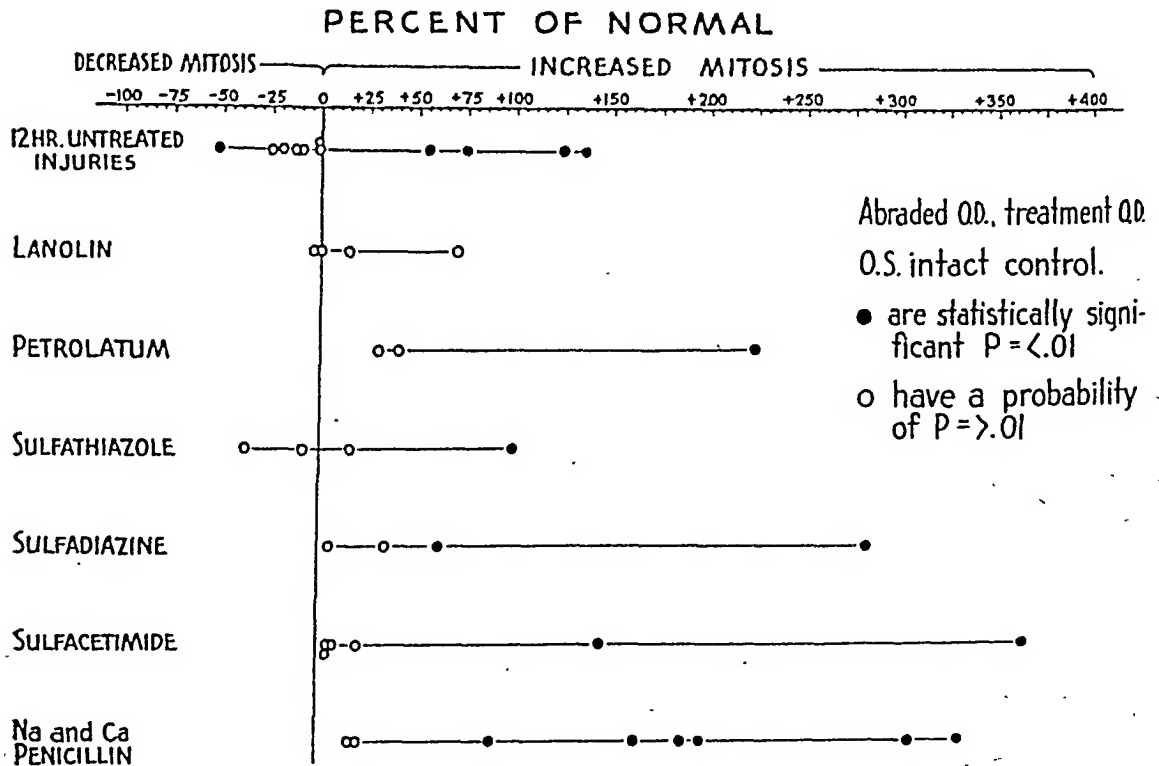


Fig. 2 (Smelser and Ozanics). The effect of sulfonamides, penicillin, and ointment-base materials on 12-hour corneal abrasions.

whether they were applied as powders or ointments. The corneas treated with sulfathiazole powder consistently contained fewer mitotic figures than did the untreated (normal) control eyes. However, this depression was marked in only one case and was not observed in the ointment-treated series. Sulfadiazine also differed from the others, but this sulfonamide caused an increase in cell division in each cornea to which it was applied. This effect was obtained in both the ointment and powder series and, while not extreme, was consistent. Penicillin

with another but similar preparation did not show any depression in cell division.

## II. EXPERIMENTS ON ABRADED CORNEAS

An extensive series of experiments was conducted on the rate of healing of corneal abrasions, the results of which are not entirely ready for publication. However, it was noted that cell division, with some exceptions, did not appear to have an important role in the immediate healing mechanism of abrasions. Following abrasions made as aforescribed, the intact cells moved inward over the naked

stroma and covered the defect in 12 to 18 hours. The normal thickness of the epithelium was then restored by cell division, which proceeded at essentially the normal rate. After 36 hours no cases were found in which there was an elevated rate of cell division. Of 11 abrasions studied 12 hours after injury, only 4 showed more

case of the ointment bases and sulfathiazole. All of the animals treated with sulfadiazine, sulfacetimide, and penicillin had more mitoses in the injured eye than in the intact. This was particularly evident and significant in the sulfadiazine- and penicillin-treated groups.

A second series of experiments was

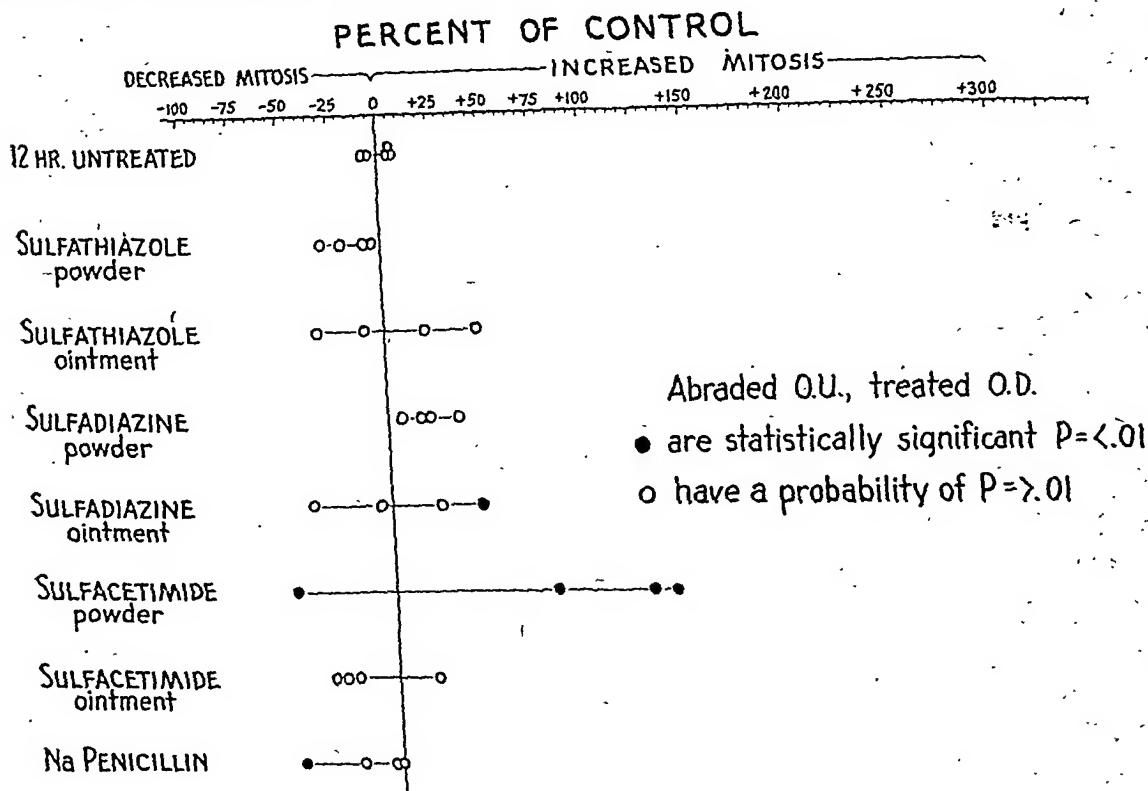


Fig. 3 (Smelser and Ozanics). The effect of sulfonamides and penicillin on 12-hour corneal abrasions.

mitotic figures than did the uninjured eye of the same animal (fig. 2). Ointment bases (lanolin, petrolatum), sulfathiazole, sulfadiazine, sulfacetimide, and Ca and Na penicillin were applied to such injuries. The ointments and powder experiments were grouped together and the results are shown in figure 2. This series was intended to show whether a normal rate of cell division occurred in the treated eye. The treated abrasions of the right eye were therefore compared with the left untreated, intact eyes of the same animals. The mitotic activity appeared to be increased by treatment except in the

conducted in which both eyes were abraded and one (right) was treated with the same chemotherapeutic agents as in the first series. This series permitted a closer comparison of the effect of the drug itself. The experiment rested on the assumption that the number of mitotic figures was equal in the two abraded eyes. The results from the untreated control animals show that the number of the mitotic figures of one eye did not vary more than 10 percent from those found in the other (fig. 3). Abraded eyes treated with sulfathiazole powder had fewer cells in division than did untreated eyes. Sulfathiazole ointment had more mitoses than

diazine and sulfacetimide, however, appeared to increase the number of cell divisions. Ointments containing the sulfonamides had no consistent effect on mitosis, although the variation between treated and control eyes was greater than when no treatment was given. Penicillin reduced the number of mitotic figures;

ard burn and the mitotic count compared with that in the contralateral, untreated, intact eye. As in the abrasion experiments epithelization was completed in 12 to 18 hours. The width of the abrasion at 12 hours was less than that of the burns, but the original injury was narrower. The results of these experiments were plotted as

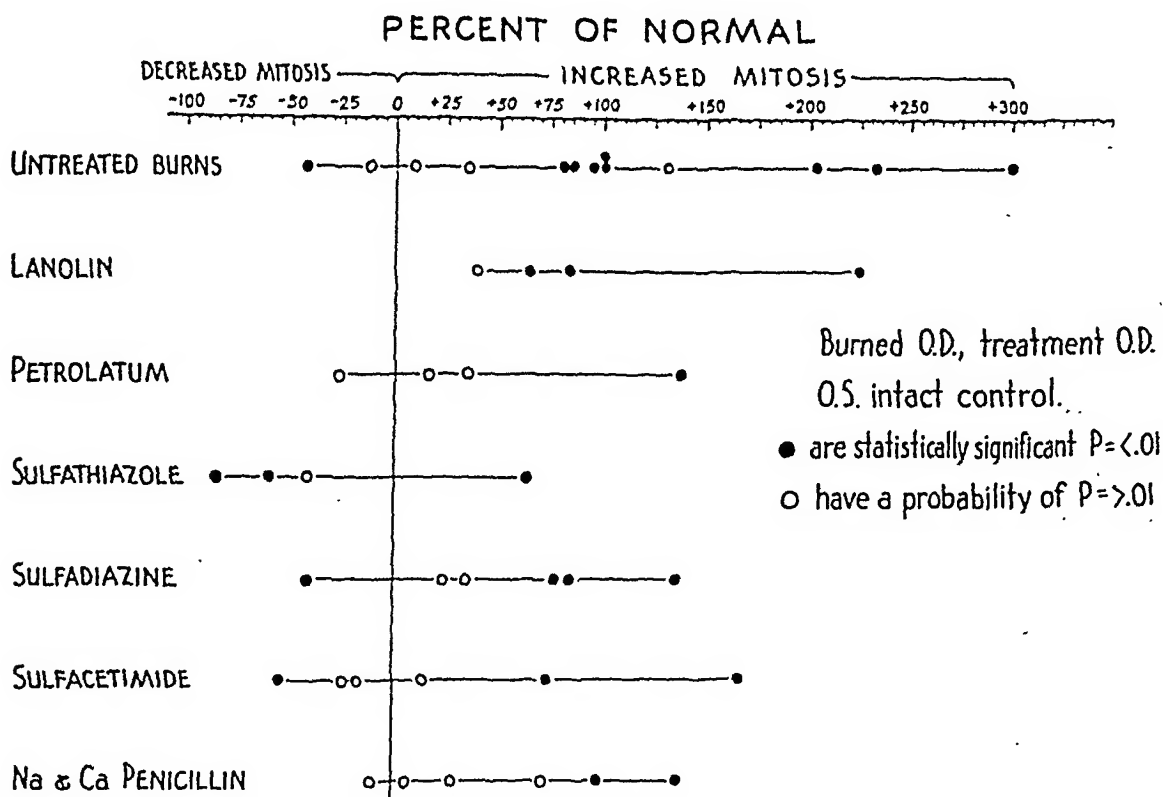


Fig. 4 (Smelser and Ozanics). The effect of sulfonamides, penicillin, and ointment-base materials on 12-hour corneal burns.

however, this was a different preparation from that used in the first series.

### III. EXPERIMENTS ON CORNEAL BURNS

The healing of thermal burns was studied exactly as in the abrasion series. The reaction of the cell-division rate was quite different here from that which followed corneal abrasions. Nineteen of the 24 (79 percent) animals we studied from 12 to 48 hours after inflicting corneal burns showed more dividing cells in the injured than in the uninjured eye. Such burns were treated as in the preceding experiments for 12 hours following a stand-

before and are shown in figure 4. Lanolin- and petrolatum-ointment bases had little or no effect on the frequency of mitosis in the burned corneas. Excepting for sulfathiazole, treatment with the sulfonamides and penicillin did not affect the number of mitotic figures found in the burned corneas (fig. 4). Sulfathiazole treatment reduced the number of mitotic figures to less than normal in three of the four animals studied, whereas the frequency was above normal in 84 percent of the controls. A second series of corneal burns was studied in which both eyes were burned and one, the right, was

treated as before. The number of mitotic figures found in the right and left eyes of untreated corneal burns was very nearly equal, none showing a statistically significant difference (fig. 5). Twenty-eight animals were treated with sulfonamides (powders or ointments) in this series. Nearly all showed more variation between epithelium as seen in the sections of treated and control burns. Each section was measured with an ocular micrometer and the values averaged. It is recognized that technical artifacts enter into these measurements, which have only relative value. It is assumed that such factors as shrinkage in the preparation of the

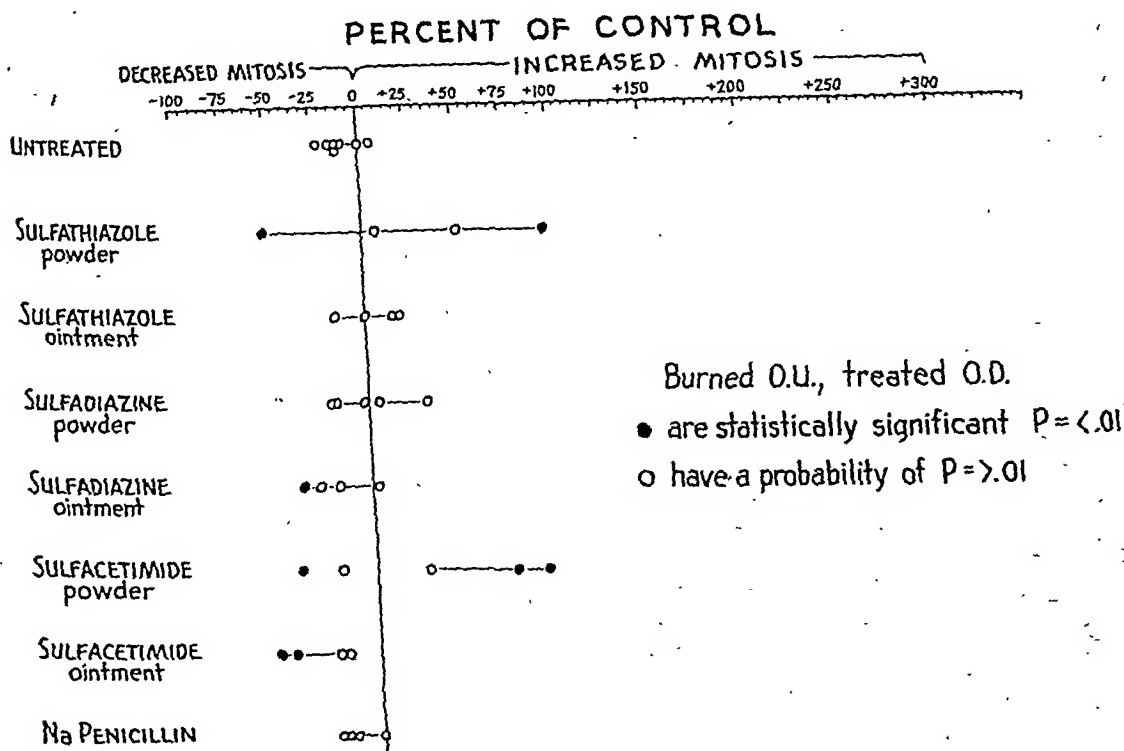


Fig. 5 (Smelser and Ozanics). The effect of sulfonamides and penicillin on 12-hour corneal burns.

the two eyes than was found in the untreated control group. None of the compounds, however, appeared consistently to inhibit cell division. More mitotic figures were found in two of the sulfacetimide-treated eyes than occurred in their control burns.

None of the substances studied appeared to inhibit the migration of leucocytes into the corneal stroma, which occurred in all injuries. It appeared to be of interest to add to the data on cell division some observations on the rapidity with which the epithelial cells migrated over the denuded area. This was determined by measuring the width of the gap in the

sections were common to both experimental and control eyes. An advantage was obtained in that the exact edge of the growing epithelium could be determined and several measurements made of the width of the gap, which varied from place to place. The data represent also the proportion of healing that has taken place 12 hours after injury, not the total time required to effect healing. The width of the gap in the epithelium of the right eye differed only 14 percent from that of the left eye in the untreated control burns. The results of these experiments are given in figure 6. All treatments apparently slowed down the epithelial movement to



some extent. Ointment bases and solutions were the least harmful in this respect. Penicillin and sulfadiazine inhibited cell movement no more than did petrolatum. Sulfathiazole and sulfacetimide, however, definitely delayed the migration of the epithelium. The powders seemed to be more detrimental in this respect than were the ointments. It will be noted that the gap in the sulfacetimide-

decrease in the early phases of this process.<sup>13</sup> These studies have usually been concerned with small abrasions. The present report deals with two types of injuries—abrasions and thermal burns—which differ in the effect they have on cell division. There was a decrease in the number of mitotic figures found immediately following (six hours) both burns and abrasions; however, their number

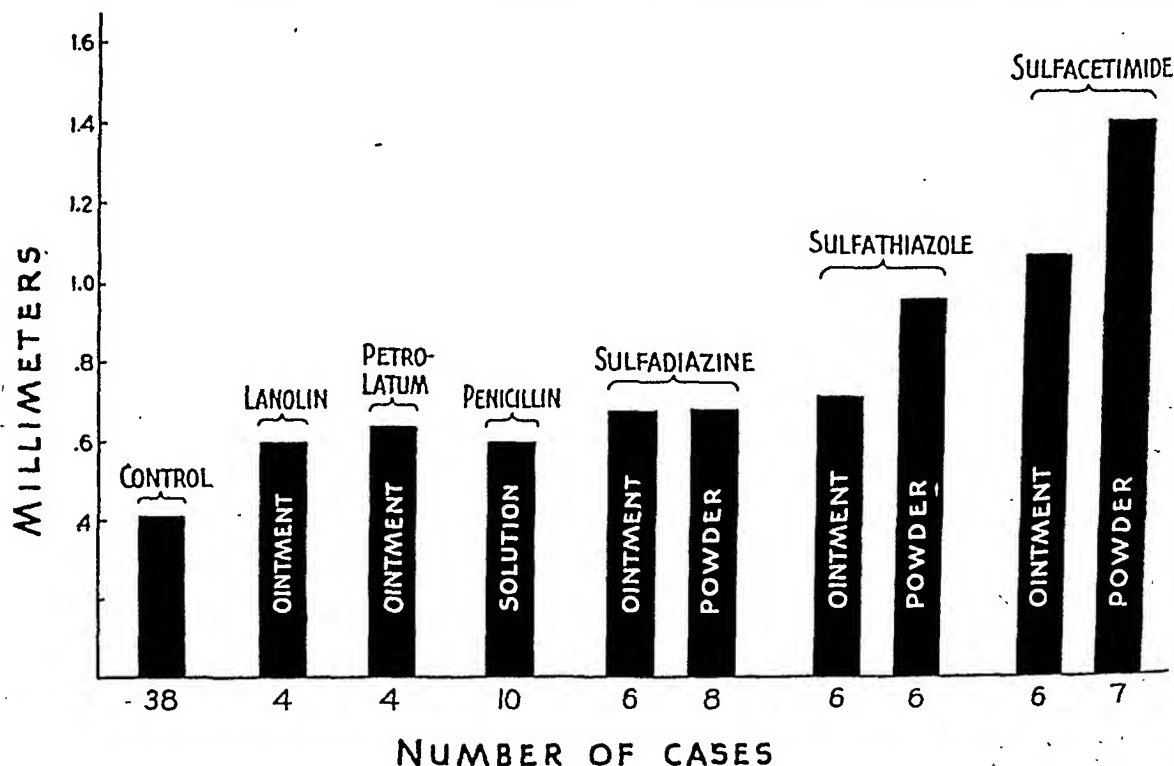


Fig. 6 (Smelser and Ozanics). The effect of treatment on the width of the gap in the corneal epithelium 12 hours following a standard thermal burn.

treated corneas measured 1.4 mm. in the sections. This value, although not necessarily the same as in the living eye, suggests that very little migration occurred and probably represents almost the entire original burned zone.

#### DISCUSSION

The role of mitosis in the healing of epithelial wounds has been considered in several investigations. It seems to be accepted that small injuries heal by migration<sup>7,12</sup> without an increase in mitosis or, indeed, the frequency of cell division may

was greatly increased in the burns so that 84 percent showed a greater than normal number of cell divisions at the 12-hour stage, during which the epithelium was actively migrating over the denuded area. A few eyes in the abrasion series also showed this increase. These cases are not in line with the conclusion of Friedenwald and Buschke<sup>13</sup> that mitosis is inhibited during the migration period. However, their injuries were very small and the experiments were concluded within seven hours.

No explanation suggests itself for the

difference in the number of mitotic figures found in the healing burns and abrasions. Heat from the cautery may stimulate cell division in the intact epithelium, but preliminary experiments along this line have not been encouraging.

These experiments suggest that cell migration is not dependent upon cell division, for both the burn and abrasion injuries were covered by epithelium in approximately the same time, 12 to 18 hours. Indeed these two phases of wound healing appear to be quite separate and are affected to a different degree by chemical agents. Cell migration was much more inhibited by sulfacetimide than by sulfadiazine powders, yet there was no evidence that sulfacetimide powder inhibited cell division. Therefore, in this experiment, as well as in the untreated injuries, the number of mitotic figures bore no direct relation to the degree or speed with which the defects were covered.

It is assumed that the effect of the several sulfonamides and penicillin on mitosis and migration is dependent, in part, upon their ability to penetrate the cells of the corneal epithelium. It may be, therefore, that the differences in effect described were partly due to this factor rather than to specific actions of the drugs. However, the materials were applied in amounts and with a frequency which should insure a maximum concentration in the epithelium, and by methods such as might be used in practice. The question of interpreting the results in terms of solubility or penetration seems to be an academic rather than a practical one. Undoubtedly a greater concentration of the drugs was obtained in the injured than in the intact corneas.<sup>14</sup> It is also possible that a greater concentration was obtained by the use of powders than ointments.<sup>2</sup> This is perhaps indicated by some of the data in figures 1, 3, and 5, in which the powders appeared to have more effect than the ointments.

The fact that the number of mitotic figures was greater in sulfadiazine-treated eyes might be interpreted to indicate slight irritation. Therefore, such positive results may not be more valuable than those produced by sulfacetimide, sulfapyrazine, and penicillin, which did not inhibit cell division in the cornea.

Healing proceeded at the most rapid rate in the untreated injuries. This observation simply confirms that made by many others. Some of the data reported here suggest that some of the drugs stimulated wound healing, because more mitotic figures were found in treated than in untreated abrasions; this, however, did not hasten the migration of cells to cover the injured area.

Reference to figure 6 shows that some of the compounds tested inhibited cell migration much more than did others. The present data on burns are in agreement with the observations of others on the influence of sulfonamides on the healing of abrasions. Bellows<sup>11</sup> found that epithelization was inhibited by sulfonamides; however, the number of cases available did not permit a demonstration of differences between them. Berens<sup>8</sup> tested one sulfonamide ointment and its base and likewise noted a delay in the healing of abrasions. Provided equal therapeutic effect is obtained, sulfadiazine and penicillin appear to be more desirable, since they were found to inhibit cell migration less than sulfathiazole or sulfacetimide, and ointments would seem to be better than powders. When cell migration is not a factor, sulfacetimide joins sulfadiazine and penicillin as compounds that have no adverse effect on mitosis in the corneal epithelium.

#### SUMMARY

1. Extensive corneal abrasions healed without a marked increase in the number of mitotic figures.
2. Thermal burns became covered with

epithelium in about the same length of time as did abrasions (12-18 hours), but a great-increase in the number of mitotic figures was found during this procedure.

3. Sulfacetimide, sulfapyrazine, and penicillin applied as ointments, powders, or solutions had no effect on cell division in the intact rat cornea.

4. Sulfadiazine tended to increase cell division and sulfathiazole to depress mitosis in this epithelium.

5. Sulfonamides and penicillin, in general, had no deleterious effect on cell division in abraded corneas, although the number of mitoses was low in over half of the sulfathiazole-treated animals.

6. Sulfonamides and penicillin did not interfere with cell division in burned corneal epithelium.

7. Sulfathiazole and sulfacetimide inhibited cell migration following corneal burns, whereas sulfadiazine and penicillin were but slightly detrimental.

8. Sulfonamide ointments inhibited cell migration slightly less than did powders.

9. It is realized that these results are qualified by the form of administration and the relative ability of the compounds to penetrate the cornea.

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#### DISCUSSION

DR. ALAN C. WOODS (Baltimore): Has Dr. Smelser any data on the effect of any other ointments, such as Aquaphor, and also for burns such as alkali burns or acid burns?

DR. SMELSER: We have been studying the effect of acid and alkali burns, but the results are not complete. We have studied Aquaphor and found it to be not so bland as lanolin.

DR. WOODS: Do you think they will run along the same general lines as thermal burns?

DR. SMELSER: I suspect they are very much like thermal burns. I was very much surprised to find that thermal burns have this definite reaction of increased cell division.

DR. WOODS: Do you think you are going to find any difference between the progress of alkali burns and the non-progressive acid burns?

DR. SMELSER: I suspect so, but our number of cases is very limited. I really do not know enough about it to discuss it.

DR. WOODS: You found just exactly the same migration of epithelium cells as Dr. Friedenwald found?

DR. SMELSER: Dr. Friedenwald has studied a different injury. He studied a prick with a needle which causes a circumscribed, almost circular injury of about 30 microns in diameter, if I remember correctly, whereas these were very wide linear abrasions which covered almost one third of the cornea.

DR. WOODS: Have you gotten far enough along on your bland ointments to offer any opinion on either the lanolin or the Aquaphor?

DR. SMELSER: I like lanolin very much. Aquaphor did cause some irritation in the rat's eye, but rodents are more sensitive than man. It might be, therefore, that Aquaphor would be satisfactory in man.

DR. WOODS: Have you tried any of the wetting agents?

DR. SMELSER: We have made some experiments, but we have not counted the mitotic figures.

DR. WOODS: Was this penicillin your own preparation?

DR. SMELSER: No, one was Lederle, one was Squibbs, and one was Pfizer. I

deliberately chose different compounds because those compounds are available generally and I wanted to use separate preparations.

DR. WOODS: Which was the less irritating?

DR. SMELSER: One sodium penicillin was irritating. The calcium salt was excellent, and apparently it was the least pure.

DR. ALLEN: Does bandaging the eye retard the healing or otherwise change it?

DR. SMELSER: We have not bandaged the eyes of any of these animals. It is a very difficult thing to bandage the eyes of any of the laboratory animals because of a good deal of struggling, and I think that the results that we might get would differ definitely from those obtained clinically. We closed the eyes of some of the animals and held others open without observing any effect on the intact epithelium, but there is a good deal of pain involved because of their attempts to open the lids, so I discarded that procedure.

DR. CLAPP: Do these mitotic cells or tissue cells pour out lipoid and cholesterol esters that interfere with healing?

DR. SMELSER: I don't know.

DR. DIMITRY: Are there any chemical changes in these tissues that account for the inhibited healing process?

DR. SMELSER: I don't believe so. Do you mean that the injury itself caused the release of substances?

DR. DIMITRY: In other words, any scar which filled with chemicals?

DR. SMELSER: In our cases there was not much scarring. Unless the operation is done badly we do not get any effect in the stroma. In all instances there was rapid healing, by which I mean the speed with which epithelium covered the gap. That is fastest if you leave it alone.

# BACKFLOW PHENOMENA IN AQUEOUS VEINS OF NORMAL AND OF GLAUCOMATOUS EYES

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## I. PREVIOUS OBSERVATIONS ON AQUEOUS VEINS OF NORMAL AND OF GLAUCOMATOUS EYES

The canal of Schlemm and the scleral venous meshwork form an anatomic unit that is charged with the elimination of the intraocular fluid. The fluid leaving the canal is brought, by intrascleral connections, into the anterior ciliary veins. A small amount of blood that enters the canal via its afferent arterioles<sup>1</sup> is a normal constituent of the contents of the canal and therefore of its outlets. Only a few outlets of the canal reach directly the surface of the sclera; before doing so, most of them join relatively large veins. Thus, their contents may become mixed with blood to a degree entirely concealing the presence of clear fluid.

In previous publications,<sup>2,3</sup> biomicroscopically visible vessels have been described which contain a colorless fluid or diluted blood, and join conjunctival or episcleral veins. They are intercalated, via Schlemm's canal, between intraocular fluid on one side, and the venous system on the other. Anatomically, they are connected with, or a part of, the intrascleral and episcleral venous meshwork. I suggested that these vessel be called aqueous veins. (fig. 1).

A few years ago, Friedenwald stated that the question as to the continuity of flow from the human eye was still to be answered.<sup>5</sup> The facts found by observation of the aqueous veins proved that this

flow must be a continuous one.

The occurrence of the aqueous veins, their appearance, and their reaction to mechanical, physiologic, and pharmacologic factors have been described.<sup>2,3,6</sup> Particular attention was directed to the stratification present in aqueous veins as well as in their recipient vessels. It is due to the simultaneous presence in one vessel of two or more strata differing in color—that is in red-cell content—and, most certainly, also in chemical composition.<sup>3</sup>

Compression, exerted by means of a minute cotton applicator on the recipient vessel near its junction with an aqueous vein, produces either one of the following characteristic aspects: the blocked vessel section including the colorless aqueous vein becomes filled with red blood cells; or the blocked vessel section becomes clearer than it was before the compression started, even quite colorless. If so, this part of the vessel resembles a transparent glass rod surrounded by semitransparent porcelainlike scleral tissue. Therefore, the effect has been called glass-rod phenomenon while the opposite aspect, the entrance of red blood cells into a previously clear vessel, is referred to as negative glass-rod phenomenon or blood-backflow phenomenon. In the second case, the aqueous phase is repelled toward, and sometimes even as far as into, the canal of Schlemm<sup>2\*</sup> which, at this instant, probably becomes filled with more than the usually present amount of blood.

The direction in which, after compression of a recipient vessel, red blood cells or clear fluid, respectively, leave or enter an aqueous vein depends on the anastomotic pathways available and on the relative pressure potentials in each of

\*From the Department of Ophthalmology, College of Medicine, University of Cincinnati, Dr. H. Reid, director. Read at the fourteenth scientific meeting of the Association for Research in Ophthalmology, at Chicago, June 13, 1944.

them.<sup>2\*,3</sup> As soon as the free flow in a vessel section is blocked the source running under higher pressure will get priority. Fluid entering the meshwork from the other source that runs under lower pressure will be repelled until a new equilibrium has been established.<sup>2†</sup>

Intraocular-pressure values have been found equally distributed over the eyes with a positive glass-rod phenomenon and those showing the blood-backflow phenomenon.<sup>3‡</sup> This rule, however, does not apply to eyes affected by glaucoma, especially primary compensated glaucoma.<sup>7§</sup> In these cases, the positive glass-rod phenomenon is an extreme rarity; more correctly, it never has been observed except in eyes the pressure of which was controlled by either miotics or surgery. In a previous publication<sup>7</sup> the nonappearance of the glass-rod phenomenon in eyes with primary compensated glaucoma was tentatively explained; this preliminary attempt is far from being complete and called for further observations.

Besides, the phenomena observed in aqueous veins were to be contrasted with other facts characteristic for glaucomatous eyes, especially with gonioscopic findings.<sup>9,15,17</sup>

## II. RECENT OBSERVATIONS ON AQUEOUS VEINS OF GLAUCOMATOUS EYES

### 1. Glass-rod phenomenon and glaucoma.

Nineteen patients suffering from primary compensated glaucoma were found to have aqueous veins. Seven of them had unilateral, and 12 bilateral glaucoma.

In this group, the glass-rod phenomenon was negative in all glaucomatous eyes. Six patients with unilateral glaucoma showed positive glass-rod phenomena in their normal eyes, whereas the sym-

metrically located aqueous veins in the glaucomatous eyes showed negative glass-rod phenomena. One of the seven patients with unilateral glaucoma reacted somewhat differently to the fundamental compression test, and his reaction was as follows:

R. W., a white man, aged 40 years, had corrected vision of 20/20 in the right eye with a +8.00D. sph.  $\approx$  +1.25D. cyl. ax. 15°. In the left eye corrected vision was 20/20 with a +7.50D. sph.  $\approx$  +1.50D. cyl. ax. 170°. The visual fields were normal. The anterior chambers were shallow; the discs normal. Intraocular pressure was: R.E. 1/6, L.E. 1/1 (Schiotz). An aqueous vein was visible in each eye, originating at symmetric positions in the nasal limbus, and, in each, the glass-rod phenomenon proved to be negative. There was, however, a difference between the right and the left aqueous vein in that the right aqueous vein, on repeated examinations, showed a lower content of red blood cells than did the left aqueous vein. When, under mild pilocarpine treatment, the intraocular pressure of the left eye became normal, the difference in the red-cell content still persisted.

2. *Influence of miotics on the glass-rod phenomenon of glaucomatous eyes.* As described in a previous paper,<sup>2\*</sup> instillation of miotics may produce a positive glass-rod phenomenon in an aqueous vein that, before instillation, showed a negative glass-rod phenomenon.

This experience was confirmed in some of the glaucomatous eyes; it occurred, however, only in those which, after administration of miotics, showed a definite decrease of the intraocular pressure. After treatment, eight patients showed a positive glass-rod phenomenon in aqueous

\* P. 37.

† P. 36, fig. 3.

‡ P. 1197.

§ P. 1312.

\* P. 1193.

veins that had a negative glass-rod phenomenon before treatment.

3. *Influence of surgery on the glass-rod phenomenon in primary compensated glaucoma.* In two eyes with compensated glaucoma that did not respond to administration of miotics the glass-rod phenomenon changed from a negative result to a positive one after successful surgery. One of these cases may be described.

C. S., a white woman, aged 55 years, had corrected vision in the right eye of 20/200 with a +3.00D. sph. The nasal lower quadrant of the visual field was missing, the defect including both the point of fixation and the blind spot. In the left eye vision was 20/20 with a +2.00D. sph.  $\approx$  +0.50D. cyl. ax. 180°. The visual field was markedly contracted. The blind spot was enlarged but did not merge with the peripheral defect. Both anterior chambers were shallow. Both optic discs were completely excavated, and a narrow halo surrounded each of them. Intraocular pressure in both eyes was II/1 (Schiotz). Under pilocarpine administration, the pressure went down to I/7 in the right eye and to I/1 in the left eye. On July 15, 1943, a cyclodialysis was performed in the upper temporal quadrant of the left eye. Intraocular pressure went down and remained I/8 for 10 consecutive months after this operation. Six months after the cyclodialysis, the eye that had been operated on showed two aqueous veins, both originating from a scleral emissarium at the 3-o'clock and at the 9-o'clock positions, respectively; in both these aqueous veins, a positive glass-rod phenomenon could be elicited. The right eye continued to show no aqueous vein; it may be mentioned that, during a preoperative observation period of 10 months, both eyes had been found to have no aqueous veins.

#### 4. *Influence of surgery on aqueous veins*

*of eyes with decompensated glaucoma.* Analogous observations were made in eyes with decompensated glaucoma after successful surgery. Three to six months after the return of the intraocular pressure to normal values, aqueous veins could be observed in some of the eyes which had not presented any at the time when the patients were admitted presenting congestive glaucoma. Some of these aqueous veins even showed positive glass-rod phenomena. In congested eyes, aqueous veins were never found.\* It takes months before an aqueous vein can be traced in an eye operated upon for decompensated glaucoma. Long before that, the eye may appear clinically quiet; even with the aid of the corneal microscope, it may fail to show any congestion; from that stage, it still takes weeks if not months before an aqueous vein can be observed.

5. *Early signs of decompensation in aqueous veins.* In some cases, the aqueous veins may show changes paralleling the course of the glaucoma. Filling of a formerly clear aqueous vein with more red cells may coincide with, or even announce, an increase of intraocular pressure.

J. D. J., a white man, aged 63 years, with shallow anterior chambers, deep cupping of both discs, combined myopic astigmatism in both eyes, and tonometer reading I/3 in the right and I/2 in the left eye, showed no aqueous veins. Under pilocarpine administration, the intraocular pressure went down to I/5 in both eyes, and the intraocular pressure remained at this level for 24 hours after the administration of the miotic in repeated examinations. At this time, in the right eye an aqueous vein with a negative glass-rod phenomenon was detected. Surprisingly, two months later, the aqueous vein could

\* P. 1312.



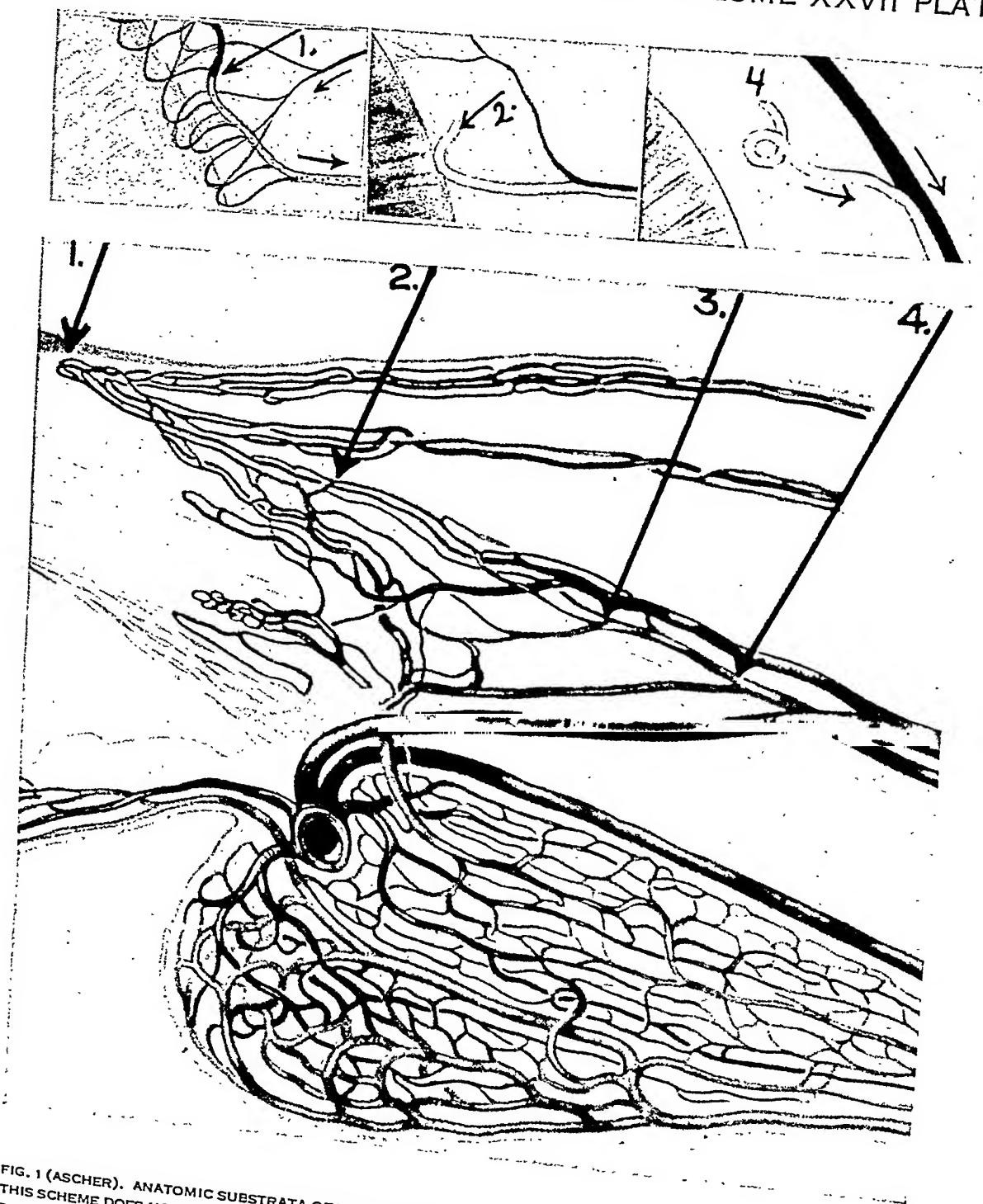


FIG. 1 (ASCHER). ANATOMIC SUBSTRATA OF THE AQUEOUS VEINS. MODIFIED FROM L. MAGGIORE'S ILLUSTRATION. THIS SCHEME DOES NOT CONTAIN THE AFFERENT ARTERIOLES THAT WERE NOT YET DETECTED WHEN MAGGIORE PUBLISHED HIS INVESTIGATIONS.<sup>4</sup> IN THE ORIGINAL, THE CROSS SECTION OF THE CANAL WAS BLUE IN COLOR; HERE, IT IS COLORLESS TO INDICATE THAT THE MAIN CONTENT OF THE CANAL NORMALLY IS A COLORLESS FLUID. ARROWS POINT AT THE SPOTS WHERE, UNDER FAVORABLE CONDITIONS, COLORLESS FLUID MAY BECOME BIOMICROSCOPICALLY VISIBLE. THESE ARE: 1, THE CAPILLARY LIMBAL NETWORK OR RANDLOOPS; 2, THE SCLERAL TISSUE ADJACENT TO THE LIMBUS; 3 AND 4, THE EMISSARIA SCLERAE. IN THE BLACK-AND-WHITE SECTION, THE ARROWS INDICATE THE DIRECTION OF FLOW.



not be recognized. The intraocular pressure was I/3, despite pilocarpine instillation. In the left eye, the tonometer reading was even I/1. Internal hyoscyamine administration was found to be the cause of this increase of the intraocular pressure. After discontinuance of this drug, the tonometer readings returned to normal values. The aqueous vein, invisible during the period of increased intraocular pressure, became visible again. During the period of increased intraocular pressure no sign of congestion or decompensation was found; the disappearance of the aqueous vein was the only objective change accompanying the higher tonometer readings.

### III. FURTHER OBSERVATIONS ON BIOMICROSCOPICALLY VISIBLE BACKFLOW PHENOMENA IN EYES WITH NORMAL INTRAOCULAR PRESSURE

Considering the fact that the positive glass-rod phenomenon does not occur in eyes with compensated primary glaucoma, further examination of eyes with normal intraocular pressure seemed to be indicated. The first question to decide was, whether the positive or negative result of the compression test, the glass-rod phenomenon, and the blood-backflow phenomenon, respectively, were regular and immutable qualities of the individual eyes, or not. Furthermore, it seemed to be imperative to investigate whether certain types of eyes with normal intraocular pressure showed a predilection for the positive or for the negative glass-rod phenomenon.

1. *Constancy of the glass-rod phenomenon.* One hundred and seven eyes showing normal intraocular pressure and aqueous veins were reexamined at intervals varying from 1 to 30 months. Forty-six of these eyes showed at least one aqueous vein with a positive glass-rod phenomenon.

On reexamination, which, in most instances, was somewhat frequent, all these aqueous veins showed the same type of compression phenomenon not only as to whether expulsion or retrograde influx of blood took place but also in the details of the progress. Thus, when at first examination the glass-rod phenomenon was very vigorous and rapid or rather slow, it proved to be the same after weeks and months. If the clear phase spread out into numerous surrounding channels at first observation,<sup>3\*</sup> the same was observed at later examinations.

If a blood-aqueous borderline appeared that showed oscillations synchronous with the pulse beat,<sup>3†</sup> the same was seen when the eye was reexamined weeks or months later. If the glass-rod phenomenon was of the weak or indecisive type at first inspection, it was neither stronger nor weaker on later observations. Exceptions to the law of constancy of the glass-rod phenomenon were observed only in pathologic eyes, as discussed in this paper.

2. *Glass-rod phenomenon and age.* Thirty-two persons showing one aqueous vein each, or more than one aqueous vein, all of them with the same type of glass-rod phenomenon, were classified according to age. None of them was younger than 20 nor older than 70 years.

TABLE 1

Among 32 persons with aqueous veins, the glass-rod phenomenon was:

	Positive	Negative
In eyes of	12 persons	20 persons
Average age	44.6 years	41.5 years
Younger than 40 years	5 persons	9 persons
Older than 40 years	7 persons	11 persons

3. *Glass-rod phenomenon and refraction.* Fifty eyes with aqueous veins were

\* P. 1196, fig. 10.

† P. 1202, figs. 14, 15.

recorded as to the glass-rod phenomenon and to the refraction of the eye. Only eyes with a refraction of more than one diopter of myopia or of hypermetropia, at least in one meridian, were included in this group. Eyes with mixed astigmatism were not included. The refraction was measured in homatropine mydriasis in all patients younger than 45 years. Intraocular-pressure readings were taken before the mydriatic was instilled. The table includes only eyes that showed a Schiøtz tonometer reading of 1/5, maximally.

TABLE 2

Among 50 eyes with aqueous veins, the glass-rod phenomenon was:

Refraction	Positive (eyes)	Negative (eyes)
	20	20
Hypermetropia and hypermetropic astigmatism	10	23
Myopia or myopic astigmatism	10	7

4. *Glass-rod phenomenon and site of aqueous vein.* Here, only eyes were considered that showed aqueous veins with an origin situated definitely in the nasal or in the temporal limbus, respectively; aqueous veins originating between the 2- and 4-o'clock positions and between the 8- and 10-o'clock positions were listed.

TABLE 3

Among 44 eyes showing one aqueous vein each, the glass-rod phenomenon was:

	Positive	Negative
Total number of eyes	19	25
Number of eyes with nasal aqueous veins	7	18
Number of eyes with temporal aqueous veins	12	7

## COMMENT AND CONCLUSIONS

1. *Discussion of the results of the present study.* The "fundamental compression test"<sup>2\*</sup> on aqueous veins of glaucomatous eyes always resulted in the negative glass-

rod phenomenon; that is, backflow of blood in the direction toward the canal of Schlemm. This is the rule for eyes affected with primary compensated glaucoma as long as the intraocular pressure has not been controlled by either miotics or surgery.

In patients with unilateral glaucoma, the eye with normal pressure may show the positive glass-rod phenomenon; that is, expulsion of blood from the blocked vessel section during compression of the recipient vessel.

In one patient with unilateral glaucoma, the eye with normal intraocular pressure did not show a positive glass-rod phenomenon; only a more vigorous output of clear fluid through the aqueous vein was visible as compared to the symmetrically located aqueous vein of the glaucomatous eye.

Administration of miotics to eyes with primary compensated glaucoma may facilitate the positive glass-rod phenomenon. This, however, occurred only when the intraocular pressure had been reduced to normal values.

After surgery, the return to normal intraocular-pressure readings is not the only condition for the appearance of the positive glass-rod phenomenon. It appeared only after the eye had become quiet and all signs of reaction to surgery had disappeared.

Analogous observations were made in eyes with decompensated glaucoma of different types after successful surgery. Here, too, it took weeks or even months before an aqueous vein and a positive glass-rod phenomenon could be observed.

Increase in intraocular pressure was sometimes announced by the filling with more red cells of a previously clear aqueous vein. With the return of the intraocular pressure to normal, the clear aqueous vein may reappear.

The glass-rod phenomenon when ob-

\* Pp. 36-37.

served in an eye with normal intraocular pressure showed a definite constancy over periods of many months. In 107 normal eyes, the glass-rod phenomenon was followed for periods up to 30 months, and on repeated reexamination, in any particular aqueous vein the same type of compression phenomenon was found which previously had been observed. Thus, the glass-rod phenomenon is not the expression of incidental conditions but it is a constant and persistent result of anatomic and physiologic facts. It is the expression of a constantly present pressure difference existing between two fluids, one of them being blood, and the other aqueous humor.<sup>2\*</sup> The glass-rod phenomenon may seem to fluctuate when influenced by physiologic, experimental, or pharmacologic factors<sup>3, 6</sup> but finally it does return to its original appearance as required by the preformed anatomic and hydrodynamic conditions.

The fact that the positive glass-rod phenomenon never occurred in eyes with compensated primary glaucoma, suggested the classification, of 107 normal eyes, presenting aqueous veins with either positive or negative glass-rod phenomenon, as to both age of the patients and refraction of the particular eyes.

The age of the patient, so important an etiologic factor in primary glaucoma, influences the appearance of the backflow phenomenon into the canal, according to Bangerter and Goldmann.<sup>9</sup> These authors have stated, that in the eyes of young persons the canal fills with blood more easily than in those of older individuals. One should expect, therefore, that in younger persons the negative glass-rod phenomenon might be more often encountered than the positive one.

In a group of 32 persons, the average age of those showing the negative glass-

rod phenomenon was 41.5 years while the age average of those with the positive glass-rod phenomenon was 44.6 years. This difference is not striking but it agrees with the gonioscopic statement that, in younger persons, the influx of blood into the canal occurs more easily than in older individuals. It would be interesting to verify this relation in a larger group of patients.

On the other hand, this finding is not in accordance with the relation between glaucoma and glass-rod phenomenon. Should the age of the patient have a bearing on both, there should be a higher occurrence of negative glass-rod phenomena in persons of high middle age and in senile persons to parallel the predisposing role of these age groups in glaucoma. Further considerations may explain this discordance (p. 1085, this paper).

Among 50 eyes recorded as to refraction and glass-rod phenomenon, a tendency toward the positive glass-rod phenomenon was prevalent in myopic eyes whereas the hypermetropic eyes revealed a tendency toward the negative glass-rod phenomenon.

This predilection of hypermetropic eyes for the negative glass-rod phenomenon is significant with regard to the frequency of glaucoma in hypermetropic eyes. Anatomic differences between myopic and hypermetropic eyes have been known for a long time.<sup>10, 11a, b, 12, 13</sup> The higher frequency of glaucoma in hypermetropic eyes has been explained by these anatomic factors; here, the supposedly greater thickness of the sclera in hypermetropic eyes<sup>10</sup> should be mentioned as a factor possibly accounting for the tendency toward the negative glass-rod phenomenon in hypermetropic eyes.

An unexpected regularity, or at least a tendency toward such, was encountered in the aqueous veins when they were classified according to their origin. I

\* P. 37.

made this classification to confirm my tentative supposition that there would be no difference in the result of the compression test whether the origin of an aqueous vein were situated in the nasal or in the temporal limbus. The table proved, however, that there seems to be a predilection for the negative glass-rod phenomenon in veins originating in the nasal limbus, whereas the positive glass-rod phenomenon was more often encountered in the veins originating in the temporal limbus.

Again, the number of eyes in this table is but small; since this table was compiled, however, similar differences were found even in aqueous veins originating in the temporal and nasal limbus of the same individual eye: in these veins, often the nasal vein showed a negative, and the temporal vein a positive glass-rod phenomenon. This, however, is a rule with exceptions.

What may be the cause of this predilection for the expulsion of red cells from temporally situated aqueous veins, under the compression test, and for the expulsion of the clear fluid from those originating in the nasal limbus? The eyeball is not at all an organ of strictly symmetrical construction. In both the scleral meshwork and the vortex veins there are differences between the nasal and the temporal half of the eye. Fuchs<sup>13</sup> stated that the design of the vortex veins is not symmetrical: In 31 emmetropic, 20 myopic, and 4 hypermetropic eyes, the temporal upper vortex vein approached the vertical meridian more than did the corresponding nasal vortex vein. In 31 emmetropic eyes, the intrascleral course of the upper temporal vortex vein measured 4.6 mm., as an average, whereas the corresponding figure for the upper nasal vortex vein was only 3.3 mm. It is questionable whether differences like those just mentioned may exert any influence

on the result of the glass-rod phenomenon. They certainly demonstrate the asymmetrical architecture of the venous drainage from the choroid.

More significant in the study of the compression test in nasally and in temporally situated aqueous veins are the figures published by Dvorak-Theobald. She counted<sup>14\*</sup> among 29 channels connecting the canal of Schlemm with the deep plexus, 12 on the nasal and 17 on the temporal side. This fact does not in itself explain the different result of the compression test in nasal and in temporal aqueous veins, it only stresses the asymmetrical construction of the temporal and nasal half of the vascular substrata for the flow of intraocular fluid. Such differences, found in one eye, do not prove the presence of similar differences in other eyes, but they do suggest the possible presence of them.

2. *Blood backflow toward, or into, the canal of Schlemm observed during gonioscopy.* Schlemm's canal and its outlets together form a biologic unit, the drainage system of the aqueous humor. While Schlemm's canal is accessible to intravital examination by means of gonioscopy, the outlets of the canal themselves are not visible intravitaly; only ascending branches connecting them with the episcleral meshwork may become accessible to biomicroscopic examination.<sup>2,3</sup> Thus, biomicroscopy and gonioscopy complement each other to further our knowledge of the admirable exhaust system consisting of the canal and its outlets.

The advantage of biomicroscopy consists in the possibility of inspecting the aqueous veins without the foregoing instillation of drugs that may change their appearance; recently, anesthetics were not regularly used before eliciting the

\* P. 592.

glass-rod phenomenon. Illumination of the eye, of course, may change the blood content of an aqueous vein, as well as do lid movements, heart action, accommodation;<sup>3\*</sup> these changes, however, are reversible and do not interfere with the natural situation prevalent in the region under observation.

The main disadvantage of the biomicroscopic access is the fact that, in many eyes, no aqueous veins are visible. This fact has been explained extensively.<sup>3†</sup> While the reaction to the compression of the recipient vessel can be observed in less than one half of all quiet eyes, the findings obtained are comparable with gonioscopic findings, and valid conclusions may be drawn from the comparison of the two opposite viewpoints.

The advantage of gonioscopy is that the canal is accessible as a whole; its main disadvantage is that the contents of the canal may be unpredictably modified by the preparations for gonioscopy. As easily as instillation of anesthetics changes the aspect of an aqueous vein<sup>6‡</sup> it may also change the normal contents of the canal. The influence of the contact lens is in discussion,<sup>9, 15, 16, 17</sup> and will not be debated here. Entrance of blood into the canal that occurs sometimes—but not always—after instillation of an anesthetic, after performance of tonometry, and after application of the contact lens, depends on the same factors of balancing equilibrium that have been assumed to be decisive for the result of the fundamental compression test on aqueous veins.<sup>3§</sup>

As early as 1915, Salzmann<sup>18</sup> described the canal of Schlemm when seen ophthalmoscopically as a gray stripe that, in some normal eyes, had a definite pink

hue. Different parts of the same canal appeared in different color: In some of the normal eyes, the canal was red on one side, and gray on the other.

Uribe Troncoso<sup>19</sup> saw in some normal eyes one or two bright red narrow lines bordering the zone of the canal on either side. The following is quoted literally: "they" (the red lines) "are due to a small amount of blood circulating inside of the Schlemm's canal, the blood collecting near the walls. Never have I been able to see the whole Schlemm zone of a red blood color." This description, and the colored picture accompanying it, have a striking similarity to certain features observed in some of the aqueous veins.<sup>2</sup>

Sugar<sup>16</sup> confirmed the occasional presence of a pink color in the Schlemm zone of normal eyes under gonioscopic examination. The only reason for the presence of blood in the canal was, according to Sugar, the pressure of the contact lens against the venous drainage channels from the canal. The pink color was seen in seven normal eyes, and in one of them on repeated examinations. In a later publication, Sugar<sup>17</sup> stated that the work on the aqueous veins explained why pressure of a gonioscopic contact glass on the conjunctival vessels may cause a backflow of blood into Schlemm's canal.

Barkan<sup>20</sup> performed gonioscopy a short time after goniotomy had been done and saw, between the 9- and 10-o'clock positions, a pink band running circumferentially around the angle wall. He explained this pink band by stripping, or pushing back from, the angle wall of the uveal meshwork. His observations are striking parallels to the withdrawal experiments of Kronfeld and co-workers.

Bangerter and Goldmann<sup>9</sup> saw that during gonioscopy blood entered the canal of normal eyes. They assumed that the pressure of the contact glass was responsible for this phenomenon. As their

\* Pp. 1198-1203.

† Pp. 1185-1187.

‡ Pp. 1307, 1308.

§ Pp. 1193-1197.



exact and important observations have been published in a foreign journal, I should like to quote them more extensively.<sup>9</sup>

In 20 out of 50 investigated normal eyes, the canal appeared red in color, but not always when the same patient was reexamined. Even during one single examination, increase and decrease of the intensity of the color was observed in the same canal. The color can disappear entirely and may, or may not, come back. Usually, the lower part of the chamber angle was darker red than the upper part. In the eyes of young persons, the canal filled more easily with blood than in those of older individuals. Shortly after the application of the contact lens, the color was usually more pronounced. When the red color had gone, compression of the neck sometimes would bring it back. This effect, however, could not always be obtained.

In a group of 40 eyes suffering from simple glaucoma a striking difference in the appearance of the canal of Schlemm was noted. Bangerter and Goldmann found the red color in the canal of only 2 among these 40 eyes whereas it appeared in 20 out of 50 eyes with normal intraocular pressure.

Kronfeld and co-workers observed entrance of blood into the canal of Schlemm<sup>16</sup> of normal eyes under different conditions: 1) when, in an eye that had been subjected to the usual preparation for gonioscopy—that is after application of a local anesthetic and insertion of the contact lens—blood was seen in the canal by means of gonioscopy, the authors spoke of a spontaneous phenomenon; in gonioscopic examination of nonglaucomatous eyes this phenomenon, according to Kronfeld and co-workers, is observed “not infrequently.” 2) When, after withdrawal of aqueous humor by needle puncture, or after compression of

the eyeball by means of the ophthalmodynamometer, blood was forced into the canal, the authors called this the induced phenomenon. The “spontaneous phenomenon” was frequently associated with a sudden decrease of intraocular pressure. After withdrawal of aqueous humor, practically every eye showed blood to be present in the canal. When the intraocular pressure returned to the level of 15 mm. Hg, the blood disappeared from the canal. If the compression by the ophthalmodynamometer resulted in lowering of the intraocular pressure, the canal became filled with blood. During the compression, the canal remained colorless. In some cases, it filled completely the very moment the compression ceased. In other cases the filling occurred slowly. Here, too, the blood disappeared from the canal as soon as intraocular pressure began to rise again. Kronfeld stated that, in his experiments on normal and on glaucomatous human eyes, pressure exerted upon the eyeball by the contact lens was not conducive to eliciting the backflow phenomenon but rather to effacing it. In eyes with narrow-angle glaucoma, partial aspiration of aqueous humor, when performed during a period of normal intraocular pressure, produced the blood-backflow phenomenon.

In a small group of eyes with primary wide-angle glaucoma, Kronfeld and co-workers found striking variations in the blood-backflow phenomenon: Withdrawal of small amounts of aqueous humor did not elicit entrance of blood into the canal of these eyes; upon aspiration of larger amounts (from 0.05 to 0.1 c.c.) some of the eyes reacted like nonglaucomatous eyes in that they showed entrance of blood into the canal. In other eyes, as much as one half of the chamber contents had to be aspirated to produce the blood-backflow phenomenon. Even then, some of these eyes presented not the regular

uniform filling of the canal but a very irregular grossly segmented band. One eye showed no blood in the canal, and Kronfeld assumed that in this case a sclerosis of the trabeculum may have completely concealed the contents of the canal.

3. *Glass-rod phenomenon contrasted with backflow into the canal.* All observers agree that in the canal of normal eyes the presence of blood may or may not be observed, but none of them, up to now, has made it clear why this occurs in some eyes and not in others.

Bangerter and Goldmann as well as Sugar concluded that the contact lens was one of the main factors causing the entrance of blood into the canal, while Kronfeld and co-workers expressed the opposite view. The explanation of this discordance may be that Sugar and Bangerter and Goldmann happened to observe mostly eyes prone to show the negative glass-rod phenomenon—that is, entrance of blood into the outlets of the canal—whereas Kronfeld's cases probably were mostly of the other type, which is prone to produce the positive glass-rod phenomenon; in these eyes, pressure exercised on an aqueous vein will expel the blood from the particular outlet and allow the entrance of aqueous humor.

The question as to whether the canal normally does or does not contain grossly visible amounts of blood is to be answered by experiments without the use of a contact lens. Instillation of anesthetics will have to be avoided in these investigations, for anesthetics increase the red-cell content of the aqueous veins,<sup>6\*</sup> and this local hyperemia may well spread into the gonioscopically visible section of the exhaust system.

The striking similarity between the de-

scription of phenomena in the canal, given by Bangerter and Goldmann,<sup>9</sup> and the phenomena observed in aqueous veins, suggests that the entrance of blood into the canal of normal eyes may be due to similar oscillations of the equilibrium between the aqueous and the sanguineous phase as those seen in aqueous veins after compression of the recipient vessel.<sup>3†</sup> In other words, the blood will not enter the canal as long as the pressure in the origin of the outlets is higher than that in the neighboring veins; any factor increasing the pressure in the intrascleral or episcleral plexus, or lowering the pressure in the canal and its immediate outlets, may induce the entrance of blood into the canal itself, provided the openings of the outlets were wide enough to allow the red cells to pass into the canal proper. Whether the gonioscopic contact lens, or application of the tonometer, or the foregoing anesthetic, or pressure of the lids, or forced expiration, or changes in the intraocular pressure, or other factors were the agent in a particular case, it will always be a disturbance of the equilibrium between the aqueous and the sanguineous phases that allows the blood to enter the canal.

The backflow of blood into the canal after aspiration of aqueous humor is a model for this working hypothesis: The lowering of the intraocular pressure will be transmitted to the canal and its contents, and immediately the blood will gain superiority over the weakened aqueous. It is the real mirror image of the negative glass-rod phenomenon: During the negative glass-rod phenomenon, blood is repelled into an aqueous vein; blood rushes back into the canal of Schlemm when intraocular pressure is reduced by aspiration of aqueous humor.

Backflow of blood in an aqueous vein

\* P. 1307.

† P. 1196.

occurs more often than does expulsion of blood (positive glass-rod phenomenon). Lid closure, even a short blinking, produces entrance of blood into the aqueous veins;<sup>3\*</sup> statistically, the positive glass-rod phenomenon has been found only in two fifths of all eyes with aqueous veins. Assuming that there is a free communication between the scleral meshwork and the canal, we may expect entrance of blood into the canal to be a common event.

On the other hand, expulsion of blood from the canal is parallel to the positive glass-rod phenomenon. Gradual expulsion of blood out of the canal of Schlemm has been observed by Bangerter and Goldmann.<sup>6</sup> They noticed that, after some time, the red color would disappear from the canal and come back, in some cases, after compression of the neck. Kronfeld and co-workers saw the red color disappear when, after a partial withdrawal of aqueous humor, the intraocular pressure increased; compression by means of the ophthalmodynamometer prevented the blood from rushing back into the canal even after withdrawal of amounts of aqueous humor apt to provoke the entrance of blood into the canal of an eye with normal intraocular pressure.

Whatever the stimulus may be that produces expulsion of blood from an aqueous vein and from its recipient vessel—whether illumination of the eye, or instillation of drugs, or pressure exercised on the recipient vessel—the result always is that a previously present balance of pressure potentials has been changed; namely, in this case, in favor of the aqueous phase. This can occur only if the aqueous phase is able to overwhelm the sanguineous phase in that particular vessel section. This condition is not present in every eye; therefore many eyes never show any positive glass-rod phenomenon;

therefore Bangerter and Goldmann saw blood in the canal in 20 out of 50 eyes with normal intraocular pressure; therefore they concluded that the gonioscopic lens enhances the entrance of blood into the canal.

Thus, the positive glass-rod phenomenon corresponds to the nonappearance of blood in the canal of Schlemm in glaucomatous eyes as observed by Bangerter and Goldmann and to the negative withdrawal phenomenon of Kronfeld and co-workers, whereas the negative glass-rod phenomenon parallels the entrance of blood into the canal of normal eyes (Bangerter and Goldmann) and the positive withdrawal phenomenon of Kronfeld.

During the positive glass-rod phenomenon, aqueous humor leaves the canal with such vigor as to expel the blood from the experimentally blocked vessel section. Looking into the chamber angle during such an experiment, one would expect that the blood would not flow into the canal, at least not at the site where the pressure was applied. During the negative glass-rod phenomenon, blood would be expected to appear in the canal under gonioscopic examination.

In the canal of Schlemm as well as in the aqueous veins, the expulsion of blood or the entrance of blood is produced by differences of the pressure potential in the aqueous and in the sanguineous phases, both being in continuous close contact with borderlines easily shifted by minute changes of the relative pressure.<sup>3\*,6†</sup> Recently Kronfeld<sup>8</sup> accepted a similar explanation of what he<sup>15</sup> had called spontaneous phenomenon.

Upon comparing the gonioscopic findings with the observations on aqueous veins one is struck by a discrepancy between the negative glass-rod phenomenon

\* Pp. 1198-1203.

\* P. 1196.

† P. 1314.

encountered in glaucomatous eyes and the rare occurrence of grossly visible blood in the canal of glaucomatous eyes. Bangerter and Goldmann<sup>9</sup> found that the canal of Schlemm was red in color in only 2 among 40 eyes suffering from simple glaucoma, whereas blood color was visible in 20 among 50 normal eyes examined gonioscopically. A more frequent occurrence of blood would be expected in glaucomatous eyes in view of the frequency in these eyes of the negative glass-rod phenomenon. Analogous discordance exists between the negative glass-rod phenomenon in glaucomatous eyes and the negative gonioscopic withdrawal phenomenon described by Kronfeld and co-workers.<sup>15</sup> Entrance of blood into the canal should be expected; the opposite, however, takes place. Apparently, withdrawal of aqueous humor brings blood into the canal of eyes with normal intraocular pressure more easily than into the canal of glaucomatous eyes. In the latter, the backflow of blood is less frequent, and less vigorous if it occurs at all.

In Bangerter and Goldmann's and also in Kronfeld's glaucomatous patients, what prevented the blood from flowing back into the canal during gonioscopy? Either the pressure in the canal was too high or the openings of the canal outlets were too narrow to allow the entrance of red cells into the canal. In the first case, no blood—neither cells nor plasma—could enter the canal. In the second case, red cells would be retained but plasma could be forced into the canal.

In the sense of the first assumption, Verhoeff raised the interesting question as to whether "with a normal filtration angle and with high intraocular pressure, the aqueous flow would be increased and the clear stream"—in the aqueous veins—"would be longer."<sup>21</sup> I can state that in none of the glaucomatous eyes observed

up to now has a more extensive or more vigorous elimination of clear fluid been seen except in eyes the pressure of which had been controlled by either miotics or surgery.

A case of positive glass-rod phenomena in an eye successfully operated on has been described in this paper, and in a previous publication<sup>7\*</sup> a 67-year-old woman with postoperative filtration blebs was mentioned because of the presence in one of her eyes of an aqueous vein with a very vigorous flow of aqueous humor. In other eyes, instillation of 5-percent sodium-chloride solution would conceal aqueous veins by rapid influx of red blood cells;<sup>†</sup> in this eye, instillation of the hyperosmotic fluid did not alter the appearance of its aqueous vein (fig. 2).

The observations of Bangerter and Goldmann<sup>9</sup> and of Kronfeld and co-workers<sup>15</sup> concerning the rare appearance of blood in the canal of glaucomatous eyes would seem to point to a very high pressure prevailing in the canal. Together with the absence of a positive glass-rod phenomenon, however, it points to a retention of fluid somewhere between the canal and the scleral venous meshwork and to the location of the impediment in, or very near, the outlets of the canal.

The gonioscopically observed absence of blood backflow into the canal and the absence of expulsion of blood from the compressed recipient vessel of an aqueous vein can be reconciled only by the assumption of a narrowing of the links connecting the canal and the scleral venous meshwork.

When in Kronfeld's case 1218<sup>15†</sup> the intraocular pressure dropped from 42 to 10 mm. Hg and no filling whatsoever of the canal was observed, an extreme scler-

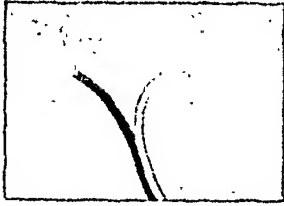
\* P. 1312.

† P. 1204.

‡ Pp. 1167-1168.

rosis of the trabeculum was assumed. An extreme and irreversible narrowing of the outlets from Schlemm's canal might well be considered to be the cause.

HARRY S. ♂ 76Y. WHITE



1942 MARCH 13 9:30 ONE DROP OF 5% NaCl SOLUTION INSTILLED

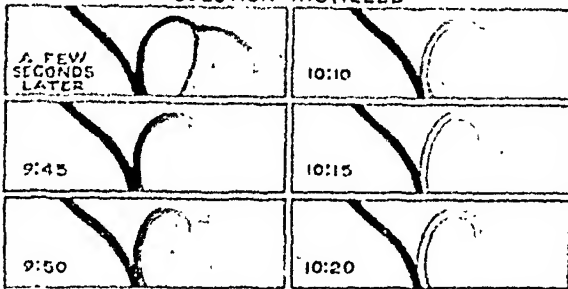


Fig. 2 (Ascher). Influence of instillation of 5 percent sodium-chloride solution on an aqueous vein. H. S., 76 years old, a white man, was aphakic after cataract extraction. At the 6-o'clock position an aqueous vein originated from the depth of the sclera with two fading roots. By emptying into a conjunctival vein, it produced stratification in the recipient vessel.

After instillation of 5-percent NaCl solution, the aqueous vein became filled with numerous red cells, and its deep intrascleral roots became clearly visible. Stratification disappeared for 15 minutes. For 45 minutes, the aqueous vein retained a gradually diminishing red-cell content. One hour after instillation, the aqueous vein was as clear as when the experiment started.

If the narrowing of the outlets is of the reversible type we must expect that the blood backflow into the canal will reappear after successful treatment by miotics or after successful surgery.

Where does this narrowing take place? Is it the cause or the effect of the increased intraocular pressure?

Histologic examination would be necessary to answer the first question and it should be done in as painstaking a manner as the work on the canal and its outlets by G. Dvorak-Theobald.<sup>14</sup> Exact

measurements of the vessels leaving the canal will be necessary to answer the first question. Material for this research will not be obtained easily: eyes in early stages of compensated glaucoma are rarely submitted to pathologic examination.

The second question, as to whether the narrowing of the outlets is the cause or the consequence of the glaucomatous process, or at least of the increase in intraocular pressure, is of paramount interest but not easily answered. One fact seems to favor the assumption that at least sometimes the narrowing of the outlets is produced by the increased pressure. That is the reappearance, after successful treatment by miotics or by surgery, of the positive glass-rod phenomenon. This observation proves that the assumed narrowing is not a permanent change but a transient condition at least in those eyes which, after reduction of their intraocular pressure, are able to reestablish a positive glass-rod phenomenon.

In cases of this kind, the reversible narrowing of the outlets from the canal should be considered to be a consequence of the increased intraocular pressure. For this question, the figures pertaining to the size and shape of the outlets of the canal are to be recalled.

The outlets are, according to all investigators of this region, not circular in diameter but elliptic, the longer diameter being tangential to the corneal limbus, the smaller diameter corresponding to the sagittal, or antero-posterior, direction. Dvorak-Theobald<sup>14</sup> found the narrowest outlets to measure as little as five micra in the smaller antero-posterior diameter; even if an allowance for possible shrinking of the specimen is made, we can expect that these outlets, elliptic in shape, may easily be compressed by increase of the intraocular pressure. It is not necessary to assume a complete compression, which is rather improbable considering the re-

sistance of the tissue that contains these structures; a marked narrowing without complete contact between the anterior and the posterior vessel walls may be sufficient to interfere with the outflow of intraocular fluid as well as with the backflow of blood cells into the canal, even after aspiration of aqueous humor. Successful surgery may restore the former size of the outlets by reducing intraocular pressure and relieving pressure on the corneoscleral junction. Thus, the flow of fluid from the canal as well as the backflow of blood into the canal may be re-established. But it is possible that, in cases of longer duration, the compression of the outlets of Schlemm's canal may become fixed and irreversible, and that, in other cases, it may develop idiopathically.

Pathologic changes in the limbal and paralimbal area may involve the vascular structures surrounding the canal of Schlemm. Narrowing of these structures, particularly of the outlets proper, may produce retention of fluid in the canal. Interstitial keratitis, scleritis in the limbal area, and tumor growth are processes likely to result in this kind of narrowing of the canal outlets. Any outlet involved by this narrowing will fail to show a positive glass-rod phenomenon as long as the narrowing persists. All other outlets may retain their original type of reaction as long as the intraocular pressure does not interfere. Idiopathic narrowing may occur similar to the narrowing of the afferent arterioles of the canal suggested by Friedenwald.

4. *Aqueous veins in the classification of glaucoma.* Due to war-time restrictions, this chapter had to be omitted.

5. *Aqueous veins as pathways of decompensation.* Due to war-time restrictions, this chapter had to be omitted.

6. *Aqueous veins and the inverted Wes-*

*sely effect in glaucoma.* Due to war-time restrictions, this chapter had to be condensed.

Wessely found<sup>22</sup> that the intraocular pressure of rabbits' eyes was raised to 60 and more millimeters of mercury by subconjunctival injections of 5- or 10-percent sodium-chloride solutions. The mechanism of this effect was studied by numerous investigators and John<sup>23</sup> detected an interesting reversion of the Wessely effect in human eyes affected by simple glaucoma. These eyes not only failed to show the usual intraocular-pressure increase after subconjunctival administration of the hyperosmotic solution, they even developed a marked decrease of intraocular pressure. A tentative explanation of the reversed Wessely effect in glaucomatous eyes was offered in this section (6), considering a mechanical factor as well as the osmotic factor of the subconjunctival deposit of salt solution. The pressure exercised by the fluid deposit on the outlets of the canal may produce backflow of blood or at least of plasma, toward, and possibly into, the canal of Schlemm. This backflowing fluid had been exposed to the osmotic influence of the hyperosmotic fluid deposit. As soon as it enters the canal, it will attract, via the semipermeable trabeculae, more fluid from the anterior chamber than the normal content of the canal would attract.

7. *Statics and dynamics of the blood contained in the canal of Schlemm.* Due to war time regulations, this chapter had to be condensed.

Considering the anatomic, physiologic, and gonioscopic facts, it was assumed that in the canal of Schlemm a stratification may occur similar to that in the aqueous veins. A separation of the aqueous and the sanguineous phases inside the canal, and even a tripartite stratification, may be observed under favorable



conditions. The blood will easily collect in the peripheral extremity of the canal, whereas the corneal part will retain some aqueous humor (figs. 3, 4).

### SUMMARY

Aqueous veins are biomicroscopically visible connections leading from the canal of Schlemm to subconjunctival or conjunctival veins. They contain clear fluid, which is aqueous humor, mixed in varying proportions with blood. Entrance of clear fluid into the recipient vessel of an aqueous vein during experimental blocking has been called positive glass-rod phenomenon. Entrance of blood into a formerly clear aqueous vein after experimental blocking of its recipient vessel has been called negative glass-rod phenomenon or blood-backflow phenomenon. Recent communications about gonioscopically visible backflow phenomena in the canal of Schlemm partially agree and partially differ with the biomicroscopic observations on aqueous veins. Backflow of blood into the canal corresponds to the negative glass-rod phenomenon while the positive glass-rod phenomenon parallels the absence of blood backflow into the canal.

Normal eyes were classified according to age of the patient, refraction of the eye, and site of the aqueous veins. Refraction of the eye and age of the patient are

factors bearing on the result of the compression phenomenon. Origin in the nasal limbus predisposes aqueous veins to show negative glass-rod phenomena, and origin in the temporal limbus predisposes to the positive glass-rod phenomenon.

The glass-rod phenomenon is not produced by transient conditions but is a constant quality of the individual aqueous veins, dependent on anatomic and physiologic factors; it is the expression of a persistent pressure difference between two currents of fluid, one of them blood, the other aqueous humor.

In eyes suffering from primary compensated glaucoma, aqueous veins fail to show the positive glass-rod phenomenon. In cases of unilateral glaucoma, the fellow eye with normal intraocular pressure may show a positive glass-rod phenomenon. In eyes with primary compensated glaucoma, the flow of aqueous humor through the outlets is less vigorous. It may grow stronger after successful surgery or after successful treatment with miotics.

Transient or permanent changes in the outlets from Schlemm's canal seem to be the cause for the failure of glaucomatous eyes to show the backflow of blood into the canal, and to show a positive glass-rod phenomenon. In some cases, idiopathic changes in the outlets may even be the cause for the increase in intraocular pres-

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Fig. 3 and 4 (Ascher). Distribution of the sanguineous phase in the canal of Schlemm (schematic drawings). The probable location of the blood band was added to a picture of the canal. For these pictures, the negative #66688, Army Medical Museum, Washington, D.C., was used with the kind permission of Col. J. N. Ash, Curator.

Figure 3 shows the probably most common type of blood distribution in the canal. It demonstrates 1) that the blood, coming from vessels that enter the canal along its convex border primarily will collect near its place of entrance; 2) that, along the convex border of the canal, aqueous humor will remain in the canal; and 3) that, under gonioscopic observation, the corneal border of the blood band will appear more sharply outlined than its scleral border.

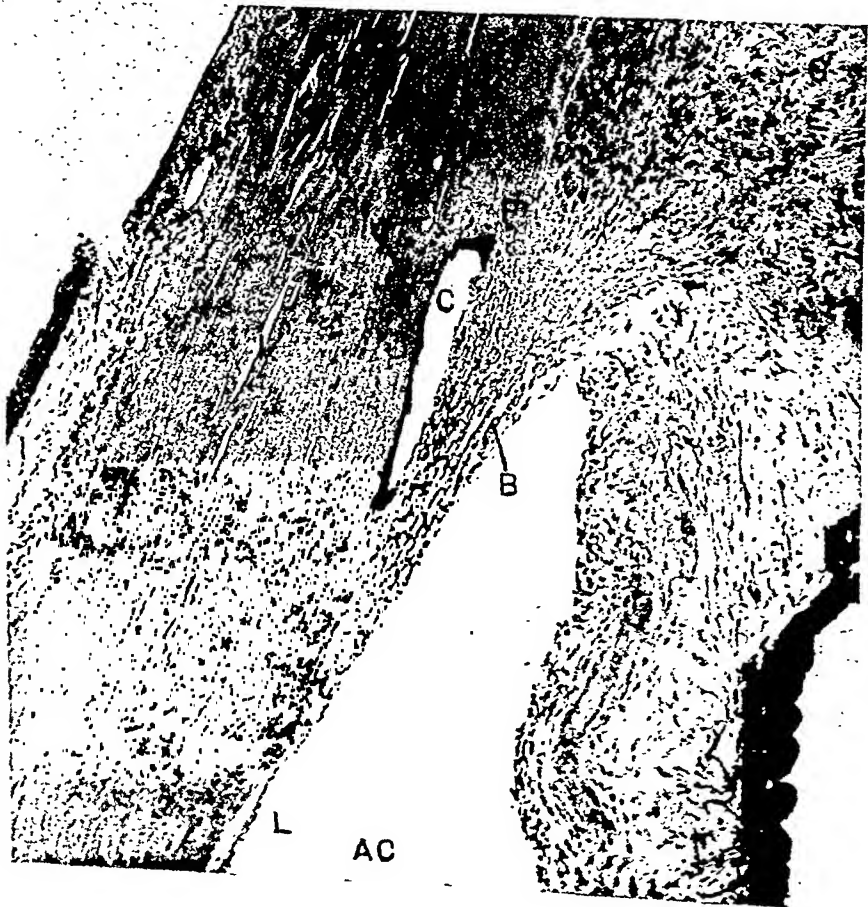
Figure 4 shows another type of blood distribution apt to produce the gonioscopic aspect of two parallel red lines in the canal as described by Uribe Troncoso.<sup>19</sup> Entering, as usual, from the convex border of the canal the blood spread along its corneal wall and formed another accumulation in the concave angle of the canal while the area adjacent to the trabeculae still was occupied by aqueous humor. Ramification of the canal, if discernible at all, may produce the same gonioscopic aspect.



FIG. 3



FIG. 4





sure. The negative glass-rod phenomenon regularly encountered in glaucomatous eyes may be considered as an early sign of decompensation.

The observations on aqueous veins are likely to explain the inverted Wessely effect observed by Isa John on eyes suffering from simple glaucoma.

The evidence is not sufficient to be con-

clusive but it is probable that blood when entering the canal will not always be completely mixed with the aqueous humor contained in the canal. At least sometimes, it will represent a separated phase and may even show stratification similar to that observed in aqueous veins.

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# THE MACULA-WEDGE SCOTOMA A PROGNOSTIC INDEX IN GLAUCOMA\*

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The following paragraphs describe what is believed to be a new prognostic central-field sign of glaucoma. An appropriate name would be the "macula wedge." Before describing this defect, it is necessary to recall certain aspects of glaucoma which form a background for the present subject.

It is always difficult to evaluate the various signs and symptoms met in the study of a particular case of glaucoma. We often feel the need of data to help us decide whether our medication should be increased in strength or frequency, and we often wish for some definite indication which will tell us whether operative measures must be instituted or whether the myotic drops are likely to be safely effective. It is a well-accepted axiom that the dose and frequency of miotics shall be maintained at the lowest effective level which will assure the desired continuous effect. Increase above this amount not only limits our future resources in proportion as the optimum dose is exceeded, but it also decreases the response of the affected tissues and gives rise to irritation relatively early in the progress of the disease. We know that the central visual acuity of certain eyes is damaged by surgical measures out of all proportion as compared to results in other apparently similar cases.

Not many years ago it was generally accepted that the progress of glaucoma was irregularly but relentlessly downhill. Every case seemed to reach a place where operative measures or blindness was inevitable. Our more meticulous studies and the accumulation in our private files of

case data which permit a broader view of the picture have enabled us to recognize certain groups in which the disease progressed through a phase toward a peak; if this were passed the condition would either become stabilized or even recede to a safer level.

It was not through tonometer readings nor through peripheral-field studies that we recognized these cases; for these methods are too unrefined. They showed us only the general features of the situation and they may be likened to the low power of the microscope, very necessary for a survey, but lacking in detail for a thorough understanding. Our modern conceptions have been formed on data derived from history, symptoms, ophthalmoscopy, slitlamp, gonioscopy, and appropriate central-field studies.

It has taken a generation of work before we could evaluate the central-field changes characteristic (but not pathognomonic) of glaucoma.

We now say that the fingerlike projections at the poles of the blindspot (Seidel's sign) are the earliest signs of glaucoma. The writer is not in agreement with some authors who believe that this sign may begin remotely and enlarge until it reaches the blindspot. He contends that this is an artifact and arises when the examiner maps a section of angioscotoma—perhaps corresponding to an oblique vessel crossing. He also contends that the Seidel sign is itself merely an incompletely mapped angioscotoma and that its value will be greatly enhanced when this is generally appreciated. With extension and increased width of the Seidel sign (angioscotoma) arching above (usually) or below (occasionally) the fixation

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point, it begins to lose its characteristic appearance and its facility of transient widening and narrowing. These characteristics emphasized by Wegener and Samojloff assume the scimitar shape and less-responsive borders of the Bjerrum defect. It is probably during this pre-Bjerrum phase that the fiber bundles begin to show damage, not through pressure at the scleral rim of the nerve, as there is

radius either from the direction of the fixation point outward or toward it from the periphery. We do this to satisfy the dictum that the object must approach the defect at right angles to its border. In using the technique of angioscotometry, a downward-dipping defect is discovered bulging toward the fixation point. It is a triangle in shape, its base arising from the concave border of the sickle defect

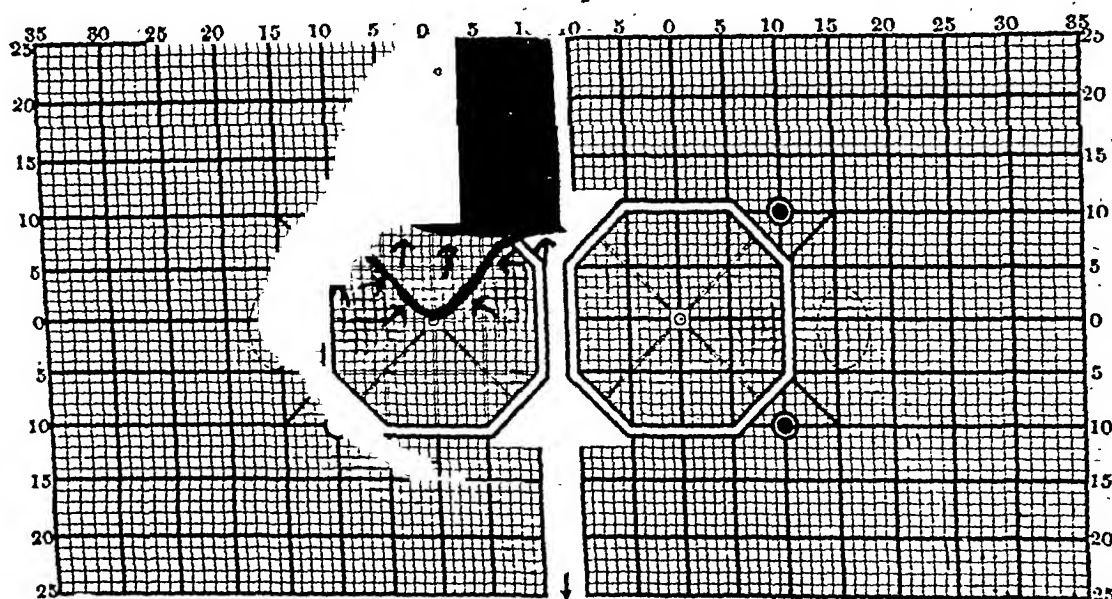


Fig. 1 (Evans). The technique: It is necessary to make special effort if one is to plot the macula wedge. The technique is that of all scotometry—the most essential feature of which is the movement of the test object at *right angles* to the supposed border of the defect. The appended chart indicates the direction of movement of the object by the arrows. When the object is moved vertically or radially from the direction of the fixation point, the prognostic wedge is *not* discovered. After the generally horizontal (solid black area above fixation) border of the defect is plotted one then moves the object parallel with this border or at least obliquely to it (note arrows) in order to approach the macula wedge at *right angles* to its border (note arrows) enclosed by continuous lines.

often little, if any, cupping at this stage, but through nutritional disturbance of the synapses and hence the fibers along the course of the paramacular arching vessels.

In order to illustrate the next phase of the evolution of these central-field changes, it is necessary to assume that we have plotted one of these arching-over defects either before or after it has assumed the classical Bjerrum appearance. Up to this time our technique has required that we move the test object along a

(scimitar or Bjerrum) and its apex toward the fixation point. In order to bring out this feature, one must move the object parallel to the border of the curving sickle defect. The writer calls this triangle the "macula wedge." His hypothesis (angioscotometry) contends that this originates primarily from stasis in the region of those spokelike radiating vascular twigs which arise from the arching-under paramacular vessels. It is the widening and lengthening of this wedge shadow, usual-

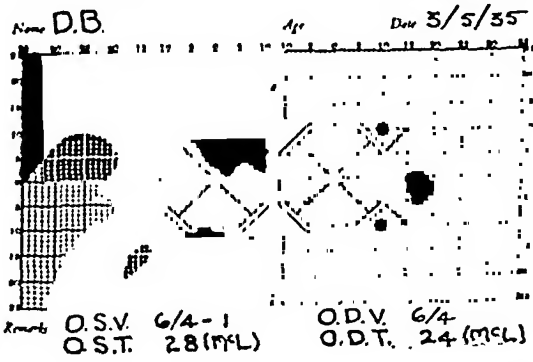
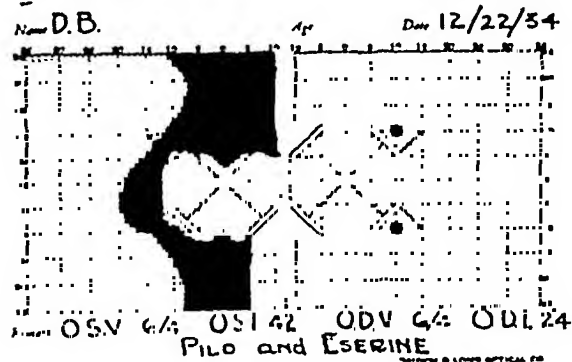
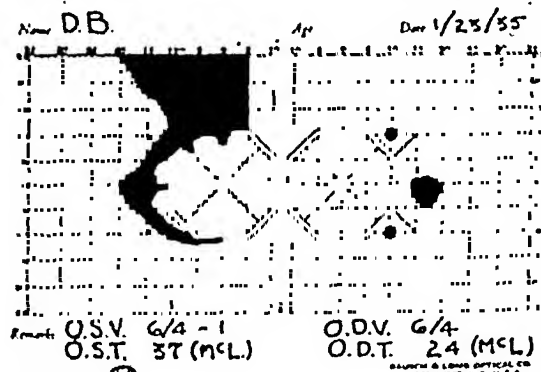
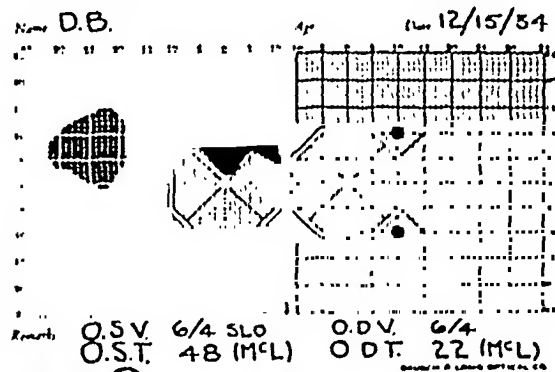
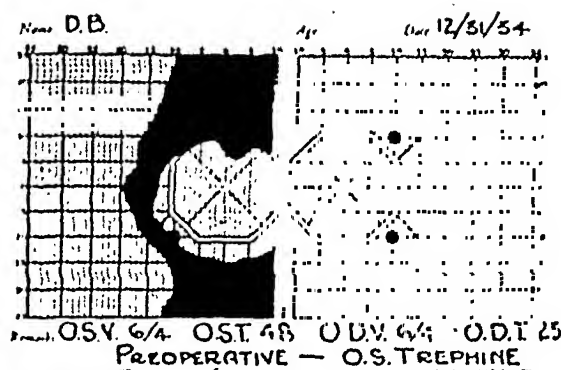
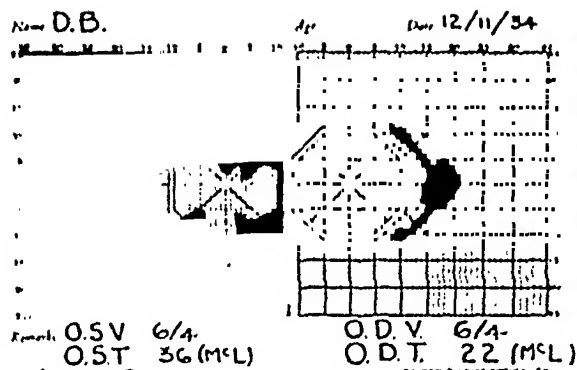


Fig. 2 (Evans). Typical fluctuations of the macula wedge. The technique was that advocated for angioscotometry (Evans). The studies were made on the stereocampimeter. The slate was under 15 feet of artificial illumination. All defects were plotted with a 0.54 minute sphere. These

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charts represent abstracts from studies on a case of noncongestive glaucoma simplex in a man, aged 58 years. The date in the upper right hand corner of each chart will indicate the order of study. The left eye alone is concerned in the present subject.

12/11/34. The entire field is obliterated except around the fixation region. We note particularly the fingerlike projections (corresponding to the radiating macular vessels of the retinal system) which protrude from above and below and point toward the fixation point. Any of these fingers are phases of the macula wedge.

12/15/34. We note that the two fingers from above have fused to form the typical macula wedge. It has approached to within two degrees of the fixation point. A new island of vision has appeared but the rise of tension and the prognostic wedge show retrogression.

12/22/34. The strength and frequency of the medication has withdrawn the apex of the prognostic wedge a degree farther from fixation and the surrounding field has cleared. Tension and the wedge indicate that medication alone cannot be depended upon. The prognostic wedge, having retracted, indicates that permanent damage has not been done the macula and that surgery will not result in reduction of central vision.

12/31/34. This chart shows that the prognosis, as indicated by the wedge retraction, has not been misleading.

1/23/35. By plotting the normal fingerlike projections on the upper edge of the scotoma, we are assured that filtration is satisfactory.

3/5/35. Reappearance of the prognostic wedge, in this instance, had its origin in circulatory insufficiency due to myocardial disease. The fellow eye showed a decreasing field at a later date.

ly from above in the central field, which causes the oval appearance of the glaucoma perimetric field in its last stages when the enlarging central defects and the narrowing nasal periphery blend into one.

Since the spokelike radiating vessels approach the macula from all directions, it is obvious that such wedge-shaped defects might appear on any meridian. This is true, but it has long been recognized that the classical central-field defects are much more common in the upper field than is the approach from other directions. This means involvement of the inferior retina, which is affected by capillary insufficiency earliest and most extensively. When we accept a vascular mechanism for these defects, we also accept the inferior or dependent retina as being most subject to circulatory insufficiency on account of the effects of biologic evolution and of gravity. We do recognize, however, that defects may develop along any radius. When such occur, we can demonstrate or postulate anatomic or pathologic peculiarities of the particular case.

The writer has never been able to demonstrate a simple, unconnected central scotoma in glaucoma simplex. He does not believe that it occurs. In all probability the "macula wedge" and its variations are the only field signs of macular damage. Occasionally an angioscotoma connects the nasal border of the enlarged blind spot with a central defect. This is, however, an atypical macula wedge, but it is very rarely encountered unless the glaucoma is complicated by lesions atypical of the simplex form of the disease.

One should, however, keep in mind the hypothesis of angioscotoma genesis, which includes perivascular-space func-

tion and synaptic response.

Many hundreds of glaucoma cases have now been studied in relation to the significance of the "macula prognostic wedge." It has been so useful that the writer presents it as an addition to the classical central-field defects of glaucoma.

The appended illustration and notes are from maps of a typical case.

Recognition of the "macula wedge" has made possible a useful home test of progress which the patient may employ under certain circumstances.

If any typical chart of a series be used as a pattern, the patient may be supplied with a sheet of the black campimeter chart paper on which two white-ink dots are placed, one at the lower border of the wedge above the fixation mark, the other one degree near the fixation mark. A black thread 200 mm. long\* is passed through the chart at the fixation mark and secured at the back by a tab of adhesive tape. The patient is asked to perform a test on himself, each morning on rising, using this device. He holds the thread against his cheek beneath the appropriate eye and while fixating the fixation mark notes whether he can see both white dots. Should either dot be missing, then he is to report at once for instructions. This device has been found very valuable, particularly when the patient is not able to report for frequent study at the office.

The same method can be used in the follow-up of other central-field defects and can, without doubt, be used as a rapid method of picking out prospective aviators who are hypersensitive to oxygen deprivation at high altitudes.

23 Schermerhorn Street.

\* The campimeter fixation distance is 190 mm. hence the thread must protrude 190 mm.



## EPITHELIAL TUMORS OF THE IRIS\*

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Although intraocular tumors are fairly common, the iris is seldom the site of neoplastic growth. In his treatise on neoplastic diseases, Ewing<sup>1</sup> mentions the iris only once, and then as the occasional site of malignant melanoma. Even metastatic tumors occur less frequently in the iris than in other parts of the uveal tract, only seven cases of metastatic new growth confined to the iris having been reported.<sup>2</sup>

Undoubtedly malignant melanoma is the commonest type of malignant neoplasm found in the iris. In a casual perusal of the recent literature published in English, more than a dozen cases were found,<sup>3</sup> but its rarity when compared to choroidal malignant melanoma is illustrated by the findings of Kronenberg<sup>4</sup> in an interesting survey of nearly a thousand eyes examined routinely at the New York Eye and Ear Infirmary during an eight-year period. One hundred and twenty-six eyes, or 12.6 percent of those examined, contained "uveal sarcoma," 88 percent of which arose in the choroid. Kronenberg added to these specimens 62 eyes of which microscopic material only was available. In this larger series (188 eyes) only 4.5 percent, or nine eyes, showed malignant melanoma limited to the iris. Gilbert<sup>5</sup> reported a series of 60 cases of uveal malignant melanoma, only one of which was primary in the iris.

Volumes have been written about the histogenesis of malignant melanoma, and no one theory is as yet universally accepted. The studies of Masson,<sup>6</sup> carried on in Montreal more than a decade ago and since verified by Foot<sup>7</sup> and others, led

those authors to believe that melanomata of the skin are neurogenic in origin. However, in the latest edition of "Neoplastic diseases" (1940) Ewing<sup>1a</sup> gives little weight to this contribution, evidently considering it inconclusive. In regard to uveal melanomata, he favors Ribbert's theory that they arise from highly specialized mesoblastic cells, the melanoblasts.

In an interesting and well-documented little book recently published in Great Britain entitled "Debatable tumors,"<sup>8</sup> the authors flatly state that malignant melanoma in man is carcinoma, whether occurring in the skin or in the eye, but that the uveal tumor is neuroectodermic carcinoma whereas they consider the skin tumor to be tegumentary ectodermic carcinoma.

Following Masson's lead, Theobald<sup>9</sup> studied serial sections of eyes containing choroidal tumors, finding in them ample evidence of involvement of ciliary nerves, from which she concluded that the tumors originated from the Schwann-sheath cells of the ciliary nerves during their passage through the choroid. On the strength of Theobald's researches, Duke-Elder<sup>10</sup> states that there is every reason to believe that the malignant tumors of the uveal tract, whether pigmented or not, are essentially developments from the cells of Schwann and are therefore neuroectodermal in origin.

On a histogenic basis, leiomyoma of the iris also deserves consideration. Duke-Elder<sup>10a</sup> discusses leiomyoma under the heading of mesodermal tumor, but admits its probable epiblastic origin in the iris, in view of the development of the sphincter and dilator-muscle fibers from the ectodermal iris during the fourth fetal

\* Candidate's thesis for membership in the American Ophthalmological Society, accepted by the Committee on Theses, 1943.

month.<sup>11</sup> Ewing does not mention the occurrence of leiomyoma in the iris. Only three verified cases of leiomyoma of the iris have been reported<sup>12</sup> and it is gratifying to note that all three have been investigated in this country.

Interesting examples of malignant melanoma and leiomyoma of the iris are at hand, but the subject of "ectodermal" tumors of the iris is too broad and controversial to be adequately covered. This discussion will be limited to a very small group of new growths which appear to be definitely epithelial in origin.

Tumors arising from the posterior epithelium of the iris are even rarer than those already mentioned. Duke-Elder<sup>10b</sup> makes short work of them, discussing only "simple melanoma of the pigment layer of the iris," stating that simple hyperplasia of the layer sometimes attains proportions which entitle it to be included among tumors. Primary malignant epithelial tumors in the uveal tract, he contends, are limited to the ciliary epithelium, and he groups them all under the heading of "medullo-epithelioma," since they arise from cells corresponding to the medullary epithelium of the primitive neural tube. Following Fuchs,<sup>13</sup> whose paper on the subject is a classic, Duke-Elder divided these intraocular tumors into "diktyomata," which resemble embryonic retina, and "malignant epitheliomata of the ciliary body," which retain the simple structure of ciliary epithelium. Verhoeff<sup>14</sup> reported one of the early cases of medullo-epithelioma in 1904. He suggested the name "teratoneuroma" for his tumor of the pars ciliaris retinae, and pointed out its relation to so-called "glioma retinae." Twenty-seven years later (1931) Grinker<sup>15</sup> published the results of studies of retinal tumors with silver impregnation, clarifying greatly the relations of medullo-epithelioma to the group of intraocular tumors known clini-

cally as glioma retinae. Verhoeff's case has been included in subsequent bibliographies of diktyomata, where it indubitably belongs, but Verhoeff could not classify it as such, since he published it four years before Fuchs coined the phrase (1908).

As an afterthought, Fuchs appends to his study of tumors of the ciliary epithelium discussion of a case reported by Hirschberg and Birnbacher,<sup>16</sup> sections of which had been sent to him for study. This tumor arose from the posterior iris epithelium. It was composed of single layers of epithelial cells, traceable directly to the pigmented retinal layer of the iris. The tumor had no connective-tissue stroma, in which respect it resembled diktyoma, but the tumor cells, always found in single rows, did not form structures resembling embryonic retina. Since the epithelium of the iris and the ciliary body has a common origin from the anterior margin of the secondary optic vesicle, tumors similar to those described for ciliary epithelium can be expected to arise in the iris.

With this in mind, several cases and the reports in the literature of new growths of the pars iridis retinae have been critically examined from the standpoint of Fuchs's classification of tumors of the ciliary epithelium. After disposing of senile and manifestly inflammatory proliferation, Fuchs discusses benign tumors of the ciliary epithelium, the so-called "adenomata," minute white masses discovered incidentally in the eyes of elderly people. Unlike inflammatory proliferation, which occurs upon the surface, these new growths are circumscribed proliferations of the ciliary epithelium, usually of the nonpigmented layer, within the body of a ciliary process. Fuchs<sup>17</sup> was the first to describe and publish an illustration of such a tumor (1883), but when Alt<sup>18</sup> presented four examples of "adenoma of the ciliary body springing from the pars

ciliaris retinae" (1898), he overlooked Fuchs's original report, an oversight which was excusable since the report was buried in a lengthy microscopic description of an eye enucleated because of a mistaken diagnosis of melanosarcoma. A typical "benign epithelial tumor of the ciliary body," the nomenclature preferred by Fuchs, occurs in elderly persons, produces no objective nor subjective symptoms because of its small size, and is discovered only accidentally. These are the clinical criteria. The microscopic appearance is constant, characteristic, and now very familiar. Although often occurring in eyes which have been inflamed, inflammatory residue is not found in and around these new growths.

Tumors which may be considered as belonging to a comparable group—benign epithelial tumors of the iris—have been reported by Stock (1905)<sup>19</sup> and by Gilbert (1910),<sup>20</sup> although both were somewhat larger than the classical adenoma of the ciliary body and were recognized clinically. However, clinical recognition in this location is not surprising, since the iris is plainly visible whereas the ciliary body is relatively invisible, and does not serve as a differential diagnostic point. Both tumors occurred in patients past middle life, were pigmented, and arose from the posterior surface of the iris. Depigmentation was necessary before cell details could be studied. Both lesions were composed of epithelial cells and contained very little connective-tissue stroma. One was very vascular, the other contained few vessels. Neither showed inflammatory exudate in or around the lesion. Both were true tumors, not inflammatory proliferation of the epithelium; both were manifestly benign, having caused no destruction of adjacent iris stroma.

Smaller examples of the same lesion presumably have been reported by Anar-

gyros (1903)<sup>21</sup> and by Schmidt (1934),<sup>22</sup> but the original articles are not available and the abstracts are too short to permit definite conclusions to be drawn.

Duke-Elder's classification of this group as "melanoma" seems unfortunate in spite of the descriptive accuracy of the term. The name selected should indicate that the lesions are true tumors and that, whether they involve primarily ciliary or iris epithelium, they arise from the same layer. Although clumsy, the term "benign epithelial tumor of iris (or ciliary) epithelium" fills these requirements and is preferred by such an authority as Fuchs.

A more complex tumor than any in the group just mentioned was described by Coats (1907)<sup>23</sup> and quoted by Fuchs<sup>13</sup> in his discussion of benign neoplasms of the iris. The growth, occurring in the eye of an old man, was pigmented and cystic. A large cyst filled one side of the anterior chamber and had split the iris into two layers, so that an atrophic layer of iris stroma was present in front of and behind the cyst. Several smaller communicating cysts contained strands of unpigmented epithelial cells. The tumor was described as arising from the epithelium of the anterior ciliary process, but it was stated that the ciliary body was not involved. The author identified the growth as similar to those described by Alt;<sup>18</sup> but rejected the term "adenoma" in favor of epithelial hyperplasia." More recently the same nomenclature has been used by Zentmayer (1936)<sup>24</sup> and by Keyes and Moore (1938)<sup>25</sup> in reporting two intraocular tumors.

Zentmayer's patient, a white married woman, 56 years old, gave a history of recurring iritis and complained of dimness of vision in the left eye. The eye was enucleated because the presence of a small tumor was inferred from the objective findings, although it could not be

seen ophthalmoscopically. When the globe was opened, a rounded tumor mass, 2 mm. in diameter, was found replacing anterior ciliary processes and the adjacent portion of the root of the iris. Verhoeff's pathologic report states that the tumor was composed of epithelium derived from the pigmented layer of the ciliary epithelium. The spaces of Fontana were "solidly filled with pigment epithelium, and heavily pigmented lumens projected from the tumor into the ciliary body."

Keyes's example occurred in a much younger woman (29 years). Vision in the left eye had been failing for a year, but there was no history of an inflammatory episode. A brown tumor mass could be seen involving the lower periphery of the iris. Keyes pointed out the similarity between his case and that of Zentmayer. His tumor was larger, measuring 3.6 mm. by 4.5 mm., was more heavily pigmented, and had been more destructive of iris stroma. Neither tumor was encapsulated, and pigment and pigment-bearing cells filled the meshwork of the angle in the second instance also. No mitoses were observed in either tumor. Keyes stresses the presence of intact basement membranes around the cords of tumor cells, even in areas where the cells had disintegrated, leaving free pigment within the membranes. His patient showed no evidence of recurrence or metastasis of the tumor two years after enucleation.

Another specimen belonging to the same group was examined in the Holmes Hospital Ophthalmological Laboratory several years ago.

The patient, a woman, aged 45

years, consulted Dr. Derrick Vail because a black spot in the iris of the right eye had been called to her attention. During the month that she had been aware of its presence there had been no apparent in-

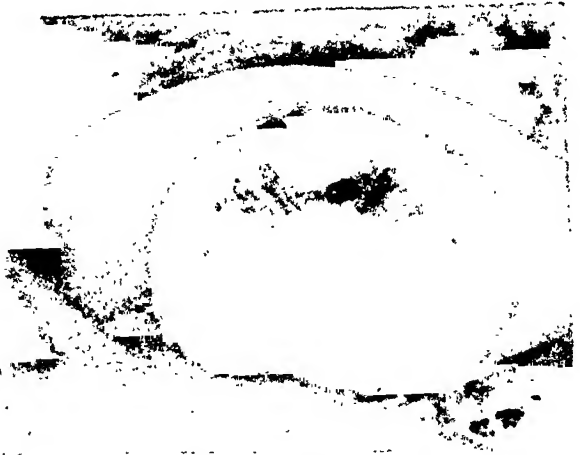


Fig. 1 (Asbury). Right eye. Brown spot 2 mm. by 3 mm. in upper periphery of iris.

crease in the size of the spot. There had been no pain in the eye and no change in the visual acuity that she could detect. The patient's general health was good, and

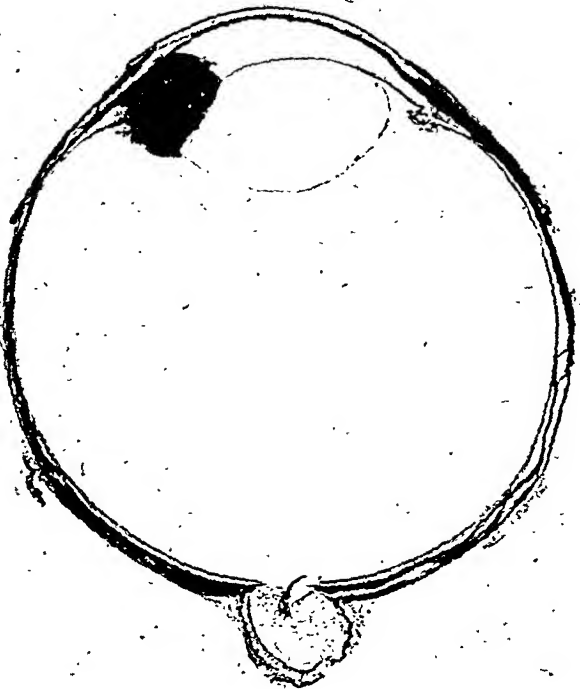


Fig. 2 (Asbury). Vertical section of right eye. Vail's case.

there was no familial history of malignant neoplasia.

The vision in each eye was 20/20. Neither eye showed any sign of either congestion or inflammation. Through the clear cornea of the right eye a brown spot



Fig. 3 (Asbury). Low power of tumor. Vail's case. Thin-walled cyst on posterior border ( $\times 14$ ).

could be seen in the upper periphery of the iris. This lesion measured 3 mm. across its base and 2 mm. in the vertical diameter. The rounded lower edge of the brown spot extended to within a millimeter of the pupillary margin (fig. 1). The pupil reacted normally but was slightly irregular. The lesion projected beyond the normal plane of the iris, rendering the upper part of the anterior chamber shallow. The pigmented nodule was solid, not a cyst. Except for slight opacity in the upper periphery of the lens adjacent to the iris lesion, the ocular media were clear and the fundus oculi was negative.

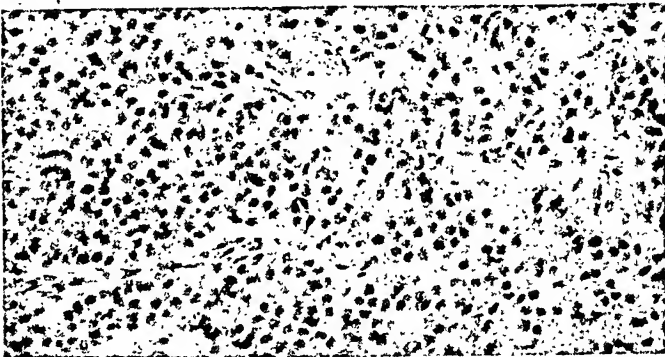


Fig. 4 (Asbury). Depigmented section, same tumor ( $\times 325$ ).

The left eye was normal.

Since it was feared that the pigmented spot was a malignant neoplasm, enucleation of the right eye was advised and performed in March, 1936.

The specimen was fixed in Szent-Györgyi's fluid. When the globe was opened in the vertical plane, little could be seen inside the eye because the fixative used had rendered the vitreous opaque.

Microscopic examination: The posterior segment of the eye was normal. The anterior segment was deformed by a black tumor mass 2.5 mm. by 4 mm. in size, which lay in the angle between the ciliary body and the iris (fig. 2). The tumor did not involve the ciliary body to any great extent, but projected forward into the anterior chamber and backward into the posterior chamber. The mass had pushed the lens forward and slightly downward. The lens had displaced the lower portion of the iris forward and the tumor had pushed the upper limb far forward, making the anterior chamber shallow. The lower pupillary border of the iris was adherent to the lens capsule. The tumor intervened between the lens and the upper limb of the iris. In its greatest diameter the tumor had replaced all of the iris tissue from the root to the lateral margin of the sphincter muscle, and was adherent to the periphery of the cornea, blocking the chamber angle (fig. 3). The corneal endothelium had disappeared in the region of contact, but Descemet's membrane was intact, and the cornea proper had not been invaded. The medial edge of the tumor was adherent to the lens capsule over the upper third of its anterior surface. The adjacent capsular epithelium had begun to proliferate and there were cataractous changes in the outer

layers of the cortex. Large macrophages filled with brown pigment had collected in the lower angle of the anterior chamber and were also found in the spaces of Fontana, around Schlemm's canal, and in the adjacent iris stroma of this part of the eye.

There were cysts on the free margin of the tumor. These contained fluid and melanin-bearing macrophages. The cysts had thin walls of flattened cells, usually unpigmented. The tumor mass was well pigmented, the cut surface appearing mottled brown. Practically every tumor cell contained melanin granules, and the majority were heavily pigmented.

The tumor was made up of cords and groups of well-differentiated epithelial cells having a pseudoglandular arrangement without true lumina. The character of the cells was best seen in bleached sections. The nuclei of the tumor cells were generally round and oval, larger than those of the iris or ciliary epithelium, although they contained similar granular chromatin patterns. Many of the tumor nuclei contained conspicuous nucleoli (fig. 4). The tumor was supported by a moderate amount of cellular fibrous-tissue stroma.

The tumor was fairly well circumscribed but not encapsulated. Unlike true adenoma, this tumor seemed to have an invasive quality. Slender cords and tubes of pigmented cells were seen in the spaces of Fontana adjoining the tumor, in Schlemm's canal and adjacent venous channels, in the loose tissue of the anterior edge of the ciliary body, and in the anterior ciliary processes (fig. 5). Silver technique stained only the fibers of the supporting tissue; the tumor cells showed no argyrophil

fibrils. Partially depigmented sections were stained with azo-carminé which differentiated the fibrous supporting tissue (fig. 6).

Six years after enucleation the patient



Fig. 5 (Asbury). Posterolateral edge of tumor. Pigmented cells in A, Schlemm's canal; in B, spaces of Fontana; in C, ciliary body ( $\times 160$ ).

was living and well. There was no evidence of recurrence of the tumor in the orbit, nor of metastasis.

The Army Medical Museum made available its material on epithelial tumors of the iris and obtained permission for the publication of the cases in the series which had not been reported. Dr. J. S. Plumer\*

\* Grateful acknowledgment is made to Dr. Plumer for permission to report this case.

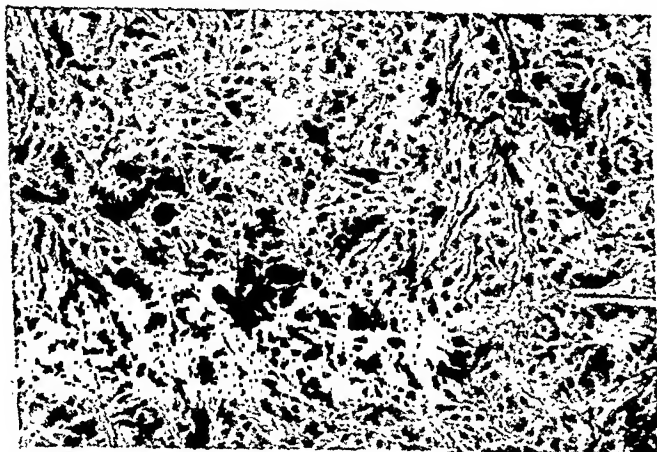


Fig. 6 (Asbury). Partially depigmented section stained with azo-carminé ( $\times 325$ ).



of Pittsburgh, Pennsylvania, contributed a case, shown in its collection, which belonged in the group under discussion.

Accession No. 55679, eye of J. B., white male, aged 64 years. The patient

not encapsulated. Pseudoacinar arrangement of the epithelial cells was visible in some parts of the tumor but was not so apparent as in the specimen previously described, being masked by marked in-

flammatory and degenerative changes present in the neoplasm.

The iris was infiltrated with inflammatory cells which increased in number toward the tumor. The reaction was pleomorphic, but cells of the lymphocytes series predominated. The medial edge of the neoplasm adjacent to the iris was heavily infiltrated with inflammatory cells, and diffuse infiltration was found throughout the tumor. Near the center of the mass nearly all the inflammatory cells were polymorphonuclear leucocytes. On both the anterior and posterior surfaces of the tumor there was a plaque of hyalinized scar tissue (fig. 8). There was



Fig. 7 (Asbury). Tumor mass replacing periphery of iris. Plumer's case ( $\times 14$ ).

was living and well three years after enucleation. One section of the eye was available for study. Microscopic description: An oval tumor mass 3 mm. by 4.3 mm. replaced the outer two thirds of the iris on the nasal side of the eye and replaced the anterior ciliary processes (fig. 7). The tumor was circumscribed but

very little pigment in the tumor, most of the epithelial cells containing none. The bulk of the tumor was without definite acinar arrangement, but near the medial edge well-formed acini were found, several of which were composed of pigmented cells (fig. 9). Aside from the more complete differentiation to form acinar structures, tumor cells in this region

did not differ morphologically from those seen elsewhere. The morphology in this region of greater differentiation was essentially like that seen throughout most of the first tumor examined at the Holmes Hospital Laboratory.

The nuclei of the epithelial cells composing the tumor varied in size, but few showed nucleoli, and none mitotic figures. At the medial edge a single layer of epithelial cells extended for some dis-

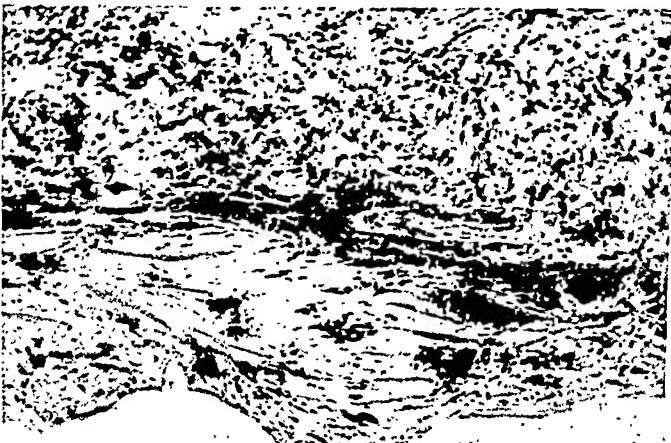


Fig. 8 (Asbury). Posterior margin of tumor showing hyalin plaque and inflammatory reaction ( $\times 160$ ).



tance over the anterior surface of the iris. The tumor was more sharply demarcated laterally than the others of the group; nevertheless, cells resembling the tumor cells, some of them containing fine pigmented granules, were found in the spaces of Fontana and in the venous channels near the angle.

The eye showed microscopic changes compatible with the age of the patient, such as sclerosis of vessels and moderate proliferation of ciliary epithelium, but no significant lesion other than the tumor in the iris. The retina and optic disc appeared normal, but the optic nerve behind the lamina cribrosa presented an unusual appearance, the significance of which was not clear.

Although it contained less pigment, the tumor in this case closely resembled the one reported by Zentmayer, especially in regard to the presence of hyalinized tissue between the groups of epithelial cells. The neoplasm in the other case (Vail), although more heavily pigmented, was otherwise identical with the tumor described by Keyes, a section of which was included in the Army Medical Museum collection. Keyes noted the similarity between the tumor he described and that reported by Zentmayer. The two cases, presented here for the first time, widen the range of variation encountered in the group as a whole. The first one (Vail) was the most heavily pigmented of the group, whereas the second tumor (Plumer) showed practically no pigment and more extensive hyalinization than Zentmayer's neoplasm. The two cases in the literature serve to emphasize the similarity of the two described here, which at first glance appeared very different. These two, the least-pigmented tumor (Plumer) and the most heavily

pigmented one (Vail), were comparable in size and equally destructive as regards the iris. Microscopically, pigment seemed to be an incidental finding in this group, not being pathognomonic, as it is supposed to be in malignant melanoma, nor did the amount present help to determine the site of origin of the tumor. Although varying widely in the degree of pigmen-

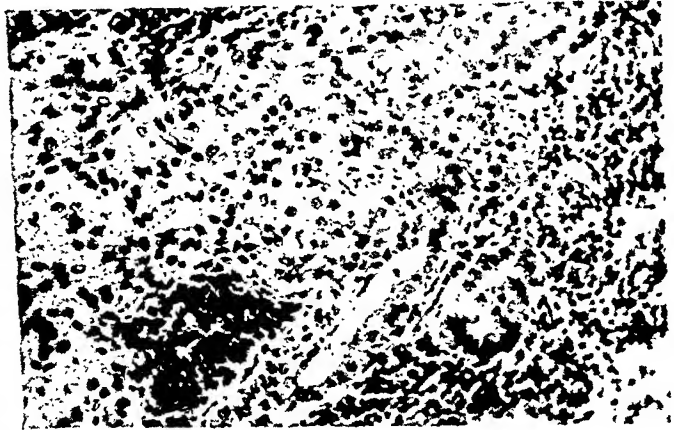


Fig. 9 (Asbury). Medial edge of tumor showing pseudoacinar arrangement of tumor cells and acini of pigmented cells ( $\times 325$ ).

tation, these four tumors had almost identical locations. The presence of abundant pigment led to the clinical diagnosis of malignant melanoma in at least two of the cases (Keyes and Vail). In all the cases enucleation was performed because the presence of malignant neoplasm was feared. Histologically the tumors fulfilled the criteria for benign neoplasia, and a favorable prognosis was substantiated by the subsequent histories.

However, all the tumors showed a tendency to invasiveness, as evidenced by the infiltration of the spaces of Fontana, Schlemm's canal, and the venous channels, and, in some instances, of the anterior part of the ciliary body. At the time of removal, all the tumors were comparatively small, but it is conceivable that, if they had remained unmolested, growth would have continued and the eyes eventually would have been de-

stroyed. Such seems to be the history of diktyoma, a rare neoplasm arising from the same embryonic structure but occurring in young individuals. Diktyoma has never been known to metastasize, but the oldest case on record, in a Chinese farmer, aged 28 years (Soudakoff, 1936),<sup>26</sup> also presented the most extensive tumor of this type yet to be reported. It had destroyed most of the structures within the eye and had perforated the sclera. As a rule the diktyomata show greater cell activity than the group of epithelial tumors under discussion, karyokinetic figures being mentioned in most of the reports. The place of diktyoma among malignant neoplasms has never been questioned, in spite of the lack of evidence of any predisposition to produce metastases. Scarcely a dozen diktyomas were found in all ophthalmic literature and none had been designated as an iris tumor.<sup>27</sup> If the line of reasoning suggested by Fuchs's classification is pursued, a diktyoma arising in the iris is a possibility. Fuchs<sup>13</sup> thought Alling's case<sup>28</sup> might be an example, but he was unwilling to commit himself because the material available to him for study was in poor condition. Probably he was influenced in making the tentative diagnosis by the youth of the patient, who was four years old. Verhoeff, who also saw the microscopic sections thought that the tumor was an endothelioma. Alling's original article described the growth as containing cartilage and epithelium. Two recent reports of diktyoma mention the presence of cartilage (Klien, Shepkalova).

Fuchs recognized malignant neoplasms of the iris epithelium and gave as an example the case reported by Hirschberg and Birnbacher.<sup>10</sup> The left eye of a man, aged 26 years, had been enucleated for the relief of pain. When the globe was opened, a gray tumor mass; 10 millimeters

in diameter, was seen on the posterior surface of the iris, displacing the lens backward. The tumor was made up of single layers of epithelial cells. It was not destructive and had only displaced normal structures, but there were tiny independent nodules of tumor cells on the anterior surface of the iris which Fuchs interpreted as metastases and which he considered ample proof that the growth was malignant. The microscopic description seems to permit this case to be classified as medullo-epithelioma of the type which occurs in adults, in this instance arising in the iris instead of the ciliary epithelium.

Other epithelial tumors of the iris have been reported in the literature. Robertson<sup>29</sup> called his specimen carcinoma, and noted mitotic figures and "colloid degeneration" in the tumor. Fuchs considered the microscopic description given by Robertson too brief to be conclusive. The mention of colloid degeneration suggests changes similar to those found in the tumors of Zentmayer and Plumer.

Although the lesion in Meller's case (1913)<sup>30</sup> was termed an epithelial tumor of the ciliary body, the iris was more involved than was the ciliary body. The eye had been blinded by long-continued inflammation resulting in extensive proliferative inflammatory changes, but the neoplastic nature of the tumor mass seemed apparent to Meller and to subsequent commentators, and the case has been included in bibliographies of medullo-epithelioma.<sup>31</sup>

Seefelder (1921)<sup>32</sup> described in a Russian prisoner, less than 30 years of age, a pedunculated pigmented tumor which was removed from the anterior surface of the iris with iridectomy forceps. That author described the growth as consisting of mantles of epithelial cells enveloping vessels. Under high magnification cell processes could be seen which ended in

footplates on an outer limiting membrane. Seefelder stated that the neoplasm was made of pigmented and unpigmented epithelial cells and glial tissue, but he was unable to classify it definitely.

More recently Terrien (1929)<sup>33</sup> published an article entitled "Remarques sur les tumeurs de l'iris." In it he reported a tumor which occurred in the left eye of a patient, aged 58 years, and which was confined to the iris. He described the neoplasm as consisting of irregular masses of epithelial cells forming thick-walled tubular structures that had central cavities filled with necrotic small anaplastic cells and extravasated blood. The tumor cells contained no pigment. Terrien stated that the tumor, which clinically resembled sarcoma, had the histologic characteristics of epithelioma.

Several other reported cases were discarded because it was decided that the tumors were not epithelial. The lesion presented by Mawas (1934)<sup>34</sup> was described as a new growth of nervous origin; and a lengthy article by Orzalesi (1935)<sup>35</sup> recorded in detail a tumor which the author considered the first glioma of the iris to be reported. The lesion in the third case in Pincus's series (1939)<sup>36</sup> was said to arise from cells of the secondary optic vesicle, and a tentative diagnosis of glioma was made. The location and general description of the tumor suggested the picture of leiomyoma of the iris. It is possible that these three tumors belong to the same group and that they did arise from the neuro-ectodermal layer of the iris.

On a morphologic basis most of the primary tumors of the iris reported in the literature fall into three groups, malignant melanomas, leiomyomas, and epithelial tumors. Many of the last-named group are pigmented, but the mere presence of melanin does not justify classifying them as melanomas. Histogenically all these

tumors may be closely related. Our present concept of the embryonic development of the intrinsic muscles of the iris makes leiomyoma a close cousin to the tumor arising directly from the posterior epithelium. The work of Klien (1936)<sup>37</sup> on melanoma of the iris of epithelial origin postulates a relation between some malignant melanomas in this area and the other two groups of iris tumors. Klien states that there are benign melanotic tumors of the iris of ectodermal origin arising "from the outer epithelial layer of the secondary optic vesicle at or near the ciliary end of the dilator muscle, which are characterized by polymorphy of cells.

"A similar origin may be taken into consideration for the malignant melanomas of the iris, which arise from its posterior surface and are also characterized by cellular polymorphy. . . ." In addition to the morphologic characteristics, an accurate classification of primary tumors of the iris must take into consideration the genetic relations of the various types, and in turn this must wait upon the final solution of the problem of their histogenesis.

In discussing gliomas of the retina, Grinker<sup>15</sup> divides the tumors arising from the secondary optic vesicle into three groups, the neuro-epitheliomas, the retinoblastomas, and the medullo-epitheliomas. The first two are retinal tumors. The third group arises from the pars ciliaris retinae where the primitive single-cell-layer form of medullary epithelium persists in adult life. The pars iridis retinae has the same origin as the ciliary epithelium and theoretically could be the site of origin of medullo-epithelioma.

Medullo-epitheliomas in the brain rarely produce metastases, and the clinical course subsequent to operation in cases of similar neoplasms in the eye is usually benign. In those cases in which recurrence

and metastasis had been reported, the diagnosis of medullo-epithelioma is open to question (Griffith, Märtens).<sup>31</sup>

The four cases considered in detail (chart 1) form a group of relatively be-

In spite of the relatively benign histologic characteristics and the favorable subsequent histories, these tumors all showed a definite tendency to invasiveness and local destructiveness. Although not

CHART 1  
DATA ON BENIGN EPITHELIAL TUMORS OF THE IRIS

Author and Contributor	Age	Sex	Eye	Duration	Size	Pigment	Postoperative History
Zentmayer 1936	56	F.	left	few months	2 mm. × 2.5 mm.	yes	Case was reported less than one year after enucleation
Keyes and Moore 1938	29	F.	left	one year	4.5 mm. × 3.6 mm.	yes, moderate amount	Two years later no extension and no metastasis
Asbury Vail	45	F.	right	one month	2.5 mm. × 4 mm.	yes, heavily pigmented	Six years later: no recurrence, no metastasis
Asbury Plumer	64	M.	?	four years	3 mm. × 4.3 mm.	very scant	Patient living and well three years after enucleation

nign epithelial tumors which affected principally the iris and arose presumably from the posterior iris epithelium or the anterior edge of the ciliary epithelium. The tumors were circumscribed but not encapsulated. Pigmentation varied within wide limits; the tumor cells were well-differentiated, karyokinetic figures were sparse. Several of the tumors showed a tendency to hyalin degenerative change. The pseudoacinar arrangement of the epithelial cells suggested the folded single-layer sheets described in medullo-epithelioma.

malignant in the sense that they produced metastases, perhaps they are malignant in the same sense as the rodent ulcer of the skin, which is included among the carcinomas (basal-cell or hair-matrix carcinoma). The epithelial tumors of the iris described here might be classed as medullo-epitheliomas, or at least as a group intermediary between truly benign epithelial hyperplasia and the lesion which, in the ciliary body, is called malignant epithelioma.

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# TRACHOMA\*

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With millions of American youths living under war conditions in endemic trachoma areas throughout the world it is highly probable that numerous cases will be returned to this country to disseminate the disease. Therefore, it is imperative that physicians, specialists and general practitioners alike, become familiar with its diagnosis and treatment.

## HISTORICAL

Trachoma has long been one of the most baffling afflictions of mankind. Such ancient seats of civilization as Palestine, Greece, Syria, Iran, Iraq, Egypt, Thailand, and French Indo-China probably have known it longest, although it is said to be endemic over half the earth's surface. Accurate statistics are not available, but estimates of incidence range from one third of the population of China, to 98 percent of that of Egypt.

Nor is trachoma confined to the East and the Near East. Thousands of fresh cases were reported in recent years in Germany. The disease is prevalent among the peasants of Poland. During the Spanish Civil War, some protest was made over the evacuation of 4,000 Spanish children to England because the disease was so widespread in Spain. Trachoma multiplied greatly in modern Greece with the influx of 1,500,000 refugees from Asia Minor in 1922.

There is considerable basis for the be-

lief that trachoma was introduced among American Indians by the early Spanish settlers. There is little doubt that the Spanish were infected with trachoma in the eighth century during the Mohammedan invasion and conquest.

The Moslem armies were composed of elements from Arabia, Asia Minor, Egypt, and North Africa, where the disease was known to have existed far back in the history of these countries. For seven centuries the Spanish Peninsula was controlled and governed by the Arabs, and commercial intercourse was transacted with North Africa and Arabia. Trachoma is prevalent in Spain today and in parts of Mexico settled by people from that country.

Following the expedition of Coronado, Oñate, in 1598, with a band of colonists composed of Spaniards and Indians, made the first permanent settlement in northern New Mexico near the present pueblo of San Juan. In the period of the next 100 years numerous settlements were made by Spaniards among Indians of New Mexico and Arizona. There was intimate contact between the Spanish and Indian groups which could easily account for the spread of trachoma.

Mention has been made of serious eye diseases among Indians in the reports of traders, explorers, and early settlers in the Indian country. Military surgeons stationed at western posts after 1860 rendered some medical care to Indians in surrounding communities and occasionally reported contagious eye diseases and blindness. The diagnosis "Trachoma"

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first began to appear in reports of Indian Service physicians about 1900.<sup>1</sup>

#### INCIDENCE IN THE UNITED STATES

Incidence of trachoma throughout the United States has never been accurately determined, as the disease is not uniformly reportable. Among non-Indians it has been endemic for years in West Virginia, Arkansas, Tennessee, Oklahoma, Ohio, Kentucky, Missouri, and Illinois, with more attention given to the problem in the latter two states. Gradle<sup>2</sup> has promoted an intensive attack under the auspices of the Department of Public Welfare of the State of Illinois. He estimates that in 1937, just preceding the inauguration of sulfanilamide treatment, there were at least 33,500 cases among non-Indians in the United States, which figure is probably conservative. He also reports a total of 3,350 cases in his Illinois clinics in the 5-year period ending in 1937, but during 1942 there were 389 new cases.

New cases of trachoma among non-Indians listed by the U. S. Public Health Service from reporting states in 1937 and in 1941 are shown in table 1. It is not believed that the figures represent an actual increase in the incidence of trachoma among non-Indians, but a better appreciation of its presence because of dissemination of knowledge concerning its disastrous effects, ease of diagnosis, and simplicity of treatment with sulfanilamide. Improvement in reporting methods may also account in large measure for the relative increase, as would closer investigation of causes of blindness among recipients of social-security benefits.

That considerable trachoma may often be found if diligent search is made is shown in the following table, as in Arkansas, where the excellent work of Cosgrove<sup>3</sup> and his coworkers is bringing to light many cases hitherto unrecognized.

The first recorded survey of trachoma among the Indians was made by the U. S. Public Health Service in 1912.<sup>4</sup> It was found that 22.7 percent of a group of 39,231 Indians examined on various reservations in the United States were found to have trachoma. The incidence varied

TABLE 1  
NEW TRACHOMA CASES AMONG NON-INDIANS

State	1937	1941
Alabama.....	11	1
Arizona.....	123	800
Arkansas.....	38	1,908
California.....	243	156
Colorado.....	1	0
Connecticut.....	4	1
Florida.....	1	0
Georgia.....	2	3
Idaho.....	0	1
Illinois.....	502	284
Iowa.....	22	0
Kansas.....	1	4
Kentucky.....	68	86
Louisiana.....	8	2
Maryland.....	2	0
Massachusetts.....	21	19
Michigan.....	4	89
Minnesota.....	10	7
Mississippi.....	50	67
Missouri.....	476	494
Montana.....	0	12
New Jersey.....	7	5
New Mexico.....	5	7
North Dakota.....	27	2
Ohio.....	435	10
Oklahoma.....	106	1,165
Oregon.....	4	7
Pennsylvania.....	12	4
South Dakota.....	2	26
Tennessee.....	118	37
Virginia.....	3	12
Washington.....	0	28
West Virginia.....	12	0
Wisconsin.....	6	2
Totals.....	2,324	5,240

from 68.72 percent in Oklahoma, the highest, to none found in the Indians of Florida. Incidence throughout the years maintained a fairly constant average of 18 to 25 percent. No appreciable progress was made in combating the disease until 1939, although thousands were treated by surgical and other means.

Table 3 shows the number of all patients examined for trachoma by special

TABLE 2

INCIDENCE AMONG NORTH AMERICAN INDIANS  
COMPARATIVE INCIDENCE BY STATE AND TRIBE: 1912-1938-1943

State	Tribes	1912		1938*		1943*	
		No. Exam.	Percent Trachoma	No. Exam.	Percent Trachoma	No. Exam	Percent Trachoma
Arizona	Apache	771	13.0	5,600	32.1	1,151	4.6
	Hopi	1,079	38.0	1,595	37.1	764	2.2
	Navajo	1,574	30.0	1,317	32.5	5,318	10.1
	Papago	500	20.0	1,339	17.7	484	2.8
	Pima	112	39.0	2,020	16.8	1,164	2.4
Total.....		4,036	27.0	11,871	27.2	8,881	7.4
California	Yuma	222	23.0	1,177	18.2	407	1.2
Idaho	Shoshone & Bannock	250	19.2	212	22.2	236	15.2
	N. Idaho	264	12.9	298	9.0	356	7.8
	Total.....	514	16.0	510	15.6	592	10.8
Montana	Blackfeet	435	20.2	899	17.6	958	38.6
	Crow	299	29.1	428	26.9	573	3.3
	Flathead	290	12.4	557	10.0	417	6.9
	Sioux	501	31.5	653	18.4	522	9.7
	Northern Cheyenne	283	39.2	341	44.8	274	10.9
Total.....		1,808	26.4	2,878	23.5	2,744	19.2
Nevada	Paiute & Shoshone	851	26.9	1,012	16.5	2,318	5.6
New Mexico	Apache (Jicarilla)	201	8.4	177	5.5	396	2.2
	Apache (Mescalero)	190	9.5	244	9.0	186	13.4
	Pueblo	845	28.4	5,536	15.0	4,955	4.5
	Total.....	1,236	15.4	5,957	9.8	5,537	4.7
Oregon	Warm Springs	181	11.0	218	21.0	180	11.1
	Nez Perce & Umatilla	150	8.6	294	30.8	298	19.1
	Total.....	331	9.8	512	25.9	478	16.0
South Dakota	Sioux	3,553	17.4	3,818	6.1	2,877	11.0
Utah	Ute	182	39.0	292	38.7	499	18.0
Washington	Spokane	351	20.2	291	10.3	536	5.7
	Dwamish (Tulalip)	168	3.5	376	6.5	440	5.9
	Yakima	306	21.2	427	5.0	446	8.7
	Total.....	825	14.9	1,094	7.2	1,422	6.7
Wyoming	Shoshone & Arapaho	392	51.0	460	32.6	348	19.8
Miscellaneous.....		25,281	22.8	20,144	20.3	15,395	3.2
Grand Total.....		39,231	22.7	49,725	20.2	41,498	7.2

\* Most are selected cases found in special eye clinics.

physicians of the U. S. Indian Service, together with the number of cases of trachoma found and the percentage incidence for 10 years from the fiscal year 1934 through the fiscal year 1943. During the years of 1937 and 1938, the older methods of treatment were used and the decrease in the incidence over this 2-

all school children were examined and an accurate cross section of the group was obtained, whereas in the preschool and adult group many of the cases were seen only because they were suffering from eye disease. The lower incidence among the school group as compared with the other group is due to the fact that

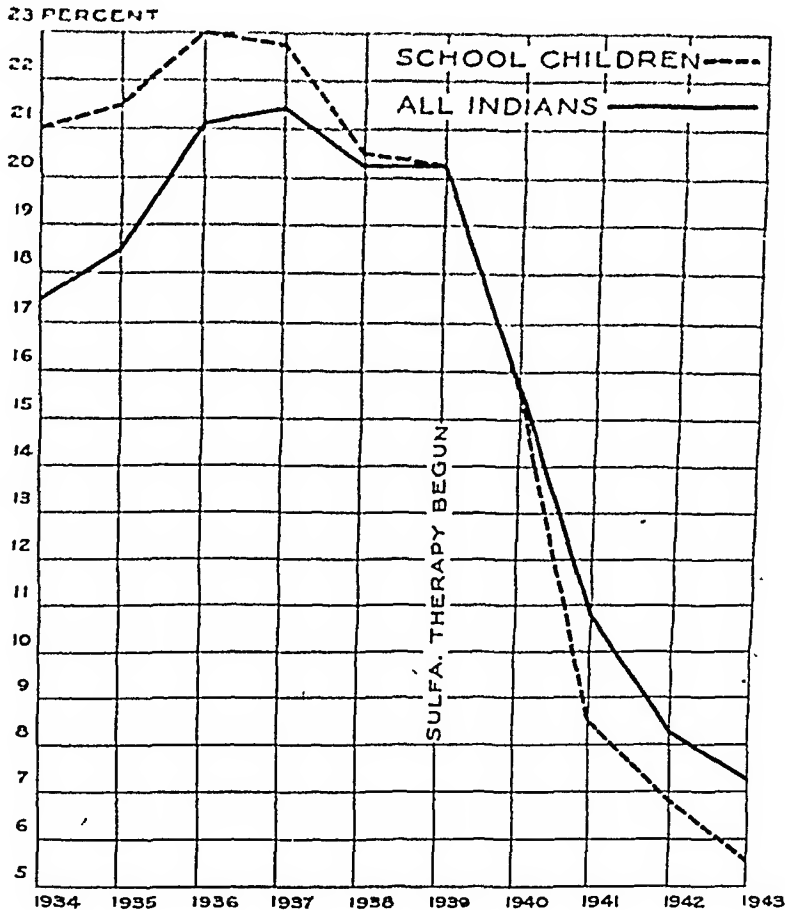


Fig. 1 (Forster and McGibony). The incidence of trachoma among North American Indians.

year period was very small. In 1939 sulfonamides were used almost exclusively. In this 5-year period from 1939 to 1943, the incidence of trachoma fell from 20.2 percent in 1939 to approximately 7 percent in 1943.

Table 4 represents the Indian-school group and gives a more accurate picture of the incidence of trachoma. Practically

the former group was under closer medical care and was regularly treated. Here again the dramatic drop in the incidence was observed beginning in 1939 when sulfonamides came into general use.

The most accurate estimates obtainable reveal the fact that in the United States there are, probably, about 125,000 blind persons (less than 20/200 vision) in the

country, a rate of about 1 per 1000 total population. No facts are available to determine the role of trachoma as a causative factor among the general population. Gradle reported in 1937 that 7.8 percent of 2,713 non-Indian trachoma patients

## ETIOLOGY

Trachoma is an infectious disease probably caused by a filtrable virus affecting the conjunctiva and the cornea of the eye, producing pain, lacrimation, and photophobia. It is characterized by a red and inflamed conjunctiva in which follicles or papillary hypertrophy are most pronounced in the conjunctiva of the upper lid and by the extension of blood vessels (pannus) from the upper limbus downward into the cornea. This pannus is frequently observed only with the aid of magnification and illumination, such as is possible with the biomicroscope or slitlamp.

The spread of trachoma may be influenced by many factors, some of which are: (1) overcrowding in the home, causing too close contact; (2) poor personal hygiene, due chiefly to the insufficient water supply; (3) lack of protection against flies; (4) conjunctival irritation due to the exposure to smoke in the home, excessive sunlight, sand and dust storms, and such factors; (5) the high incidence of bacterial infection, which results in a discharge from the eyes.

In a study in 1937 among the White Mountain Apache Indians of Arizona,<sup>5</sup> it was found that the living conditions were primitive. In a group of 68 families there were 255 individuals; 63, or 24.7 percent, showed evidence of active trachoma. The incidence for preschool children was 33.9 percent and for children of school age 34.3 percent, indicating that trachoma was established in high frequency prior to school age. There were a number of families in the group in which neither the mother nor the father had trachoma, yet one or more of the children were infected. From this study it was concluded that trachoma was a disease of the family, requiring intimate contact for transmission. However, it

TABLE 3  
EXAMINATIONS OF ALL INDIANS MADE BY  
SPECIAL PHYSICIANS

Fiscal Year Ending July 1	Number Examined	Positive Trachoma	Incidence percent
1934	53,792	9,449	17.5
1935	59,048	10,906	18.6
1936	61,840	13,079	21.1
1937	49,681	10,780	21.4
1938	49,725	10,082	20.2
1939	54,026	10,934	20.2
1940	64,634	10,074	15.5
1941	72,975	7,867	10.7
1942	49,314	4,068	8.2
1943	41,498	3,023	7.2

had vision of less than 20/200 because of the disease.

A survey in 1937, with reports from agencies representing 165,555 Indians, revealed 830 cases of blindness, or 5 per 1,000 Indians. Of these 830, trachoma was given as a causative factor in 412, or 49 percent. This would indicate that about

TABLE 4  
EXAMINATION OF SCHOOL CHILDREN

Fiscal Year Ending July 1	Number Examined	Positive Trachoma	Incidence percent
1937	39,273	8,978	22.9
1938	41,685	8,514	20.4
1939	44,235	8,970	20.3
1940	53,580	8,379	15.6
1941	56,794	4,896	8.6
1942	38,761	2,696	6.9
1943	34,419	1,859	5.4

1.5 percent of trachoma cases among Indians resulted in blindness.

In 1942, three years after introduction of sulfanilamide medication in trachoma, the number of blind Indians was found to be 617 in a reporting population of 253,263, or 2.4 per 1,000 population.

does not always follow that the disease is transferred from the parents to the children and the communicability is not great.

Braley<sup>6</sup> found no evidence to incriminate the louse as a vector of trachoma virus among Apache Indians.

In 1912 Nicolle, Blaizot, and Cuénod<sup>7</sup> conducted two experiments, employing modified Berkefeld-V filters, with bacteria-free filtrate of trachomatous material. In the first experiment, the bacteria-free filtrate produced clinical trachoma in a Barbary ape, which in turn was transferred to a human eye. In the second experiment, experimental trachoma was produced in a chimpanzee.

The work of Thygeson and Proctor<sup>8</sup> with baboons, Thygeson, Proctor and Richards<sup>9</sup> with a human, and Julianelle, Morris, and Harrison<sup>10</sup> with monkeys (*Macacus rhesus*), confirmed the filtrability of the agent of trachoma. Thygeson and Richards<sup>11</sup> concluded that the agent is filtrable under certain conditions; that it has the characteristics of a virus (filtrability, inclusion-body formation, and noncultivability on nonliving media) and that it is identical with the elementary body of Halberstädter and Prowazek.<sup>12</sup> The viruses of inclusion blenorrhea, psittacosis, lymphogranuloma venereum, and trachoma appear to form a transitional group between *Rickettsiae* and the typical viruses.

### PATHOLOGY

In the early stages of trachoma there is an increase in the number of lymphocytes in the conjunctiva, but as the disease progresses these are gradually replaced by plasma cells. Plasma cells are seen as round or oval cells with an eccentric nucleus which resembles the spokes of a wheel. Formation of new capillaries in the tarsal conjunctiva is observed extending toward the surface of the conjunctiva, at which point they end in

whorls. Cicatrization in the conjunctiva may occur in conditions other than trachoma, but it is of minor importance in their pathology. In trachoma the formation of fibroblasts is continuous with the disease in all of its stages and is very significant. This fibroblastic proliferation causes a scarring of the tarsus which results in entropion and xerosis.

The corneal pathology is of vast importance in the diagnosis of the disease. The pannus of trachoma, before the advent of the biomicroscope, was considered to be an occasional late complication of the disease. The slitlamp studies of Busacca,<sup>13</sup> Cuénod and Nataf,<sup>14</sup> Danilevskij,<sup>15</sup> Dusseldorp,<sup>16</sup> Howard,<sup>17</sup> Thygeson,<sup>18</sup> and others indicates that pannus is an integral part of the disease. Cuénod and Nataf<sup>14</sup> found biomicroscopic signs of pannus in the trachomatous eyes of children at a time when gross examination revealed no change. Wilson,<sup>19</sup> studying only the vascular changes of pannus, always found extension of capillary loops into the cornea. He observed that the pannus usually appeared at the same time as conjunctival lesions. Busacca found avascular keratitis in all cases of active trachoma that he observed and noted that it preceded vascularization of the cornea.

Thygeson,<sup>18</sup> in a study of 204 trachomatous Indian children, found no essential difference between trachoma of the Indian and that of the White. Vascularization of the cornea in this group appeared to be an extension of preëxisting limbic loops rather than formation of new blood vessels. The degree of penetration varied from one millimeter to complete vascularization of the cornea.

### DIAGNOSIS

Clinical diagnosis is based upon the characteristic appearance of the conjunctiva and the presence of a trachomatous

pannus consisting of the extension to varying degrees, of the limbal vessel loops into the clear portion of the cornea.

In the differential diagnosis there are several diseases which may very easily be confused with trachoma:

*Folliculosis* is of first importance because it is so difficult to distinguish the appearance of follicular conjunctivitis from trachoma. However, in folliculosis no characteristic corneal pathologic changes, such as pannus and infiltrates, are found. These cases do not respond to treatment with sulfanilamide as does trachoma, but they do clear up with the instillation of 0.25- to 0.5-percent solution of zinc sulfate.

*Vernal conjunctivitis* is occasionally confused with trachoma; but here the characteristic trachomatous corneal changes are not present, and the seasonal character of the disease is sufficient to rule it out.

*Inclusion blennorrhoea* may be eliminated because of its tendency to spontaneous cure without treatment and the lack of corneal involvement.

*Nutritional* disturbances, particularly riboflavin deficiency, often produce corneal vascularity, but are not easily confused with trachomatous pannus.

#### CLASSIFICATION

The stage of the disease is determined by the appearance of the conjunctiva. In both the U. S. Indian Service and the State of Illinois Trachoma Clinics, the following classification is used:

*Code (Type) I.* The primary stage of trachoma. The conjunctiva may be reddened and somewhat swollen and hyperemic. When the lid is everted, small sub-epithelial follicles can be seen under the conjunctiva, dotting the surface of the tarsus and especially prominent around the transitional folds. There is a similar appearance, somewhat less marked, in the

conjunctiva of the everted lower lid. The presence of follicles may be masked by the somewhat velvety appearance of the conjunctiva, but they can be detected when examination is made under magnification. In order to classify the appearance as Type I trachoma, *there must be beginning involvement of the cornea.* This usually occurs at the upper limbus, in the form of a slight advance of the vessels beyond the limbus, possibly slight pitting of the overlying epithelium, and small gray infiltrates in the corneal substance. Unless and until these corneal changes make their appearance, the conjunctiva above described must be classified as Code V. (suspicious trachoma) and not Code I.

*Code (Type) II.* This type exhibits more or less numerous bleblike excrescences which protrude above the surface of the rest of the conjunctiva. When pressed upon or manipulated, these little tumors often rupture easily, and their gelatinous contents escape. They are usually very prominent in the retrotarsal folds and generally fairly well scattered over the tarsal mucosa of both lids. In some cases, owing to the generalized infiltration, these excrescences or little tumors cannot be distinguished. This stage also sometimes presents papillary hypertrophy to a more or less marked degree, which is often spoken of as the raspberrylike process because of the resemblance. The corneal changes are always present to a greater or lesser extent.

*Code (Type) III.* The follicles and the excrescences seen in Type II have either disappeared entirely or are in the process of becoming absorbed. The entire conjunctiva is somewhat less thickened but is more hyperemic. The surface is apt to be irregular, owing to the development of connective tissue in the conjunctiva. Contraction of the cicatricial tissue of the eye tends to produce eversion or inversion of the lids or other similar sequelae.

*Code (Type) IV.* Healed trachoma. The conjunctiva is cicatrized, both macroscopically and microscopically. A layer of pannus is to be seen, and various scar malformations may be present. No active inflammation is visible unless secondary infection has taken place.

*Code (Type) V.* Any form of conjunctivitis which is suspicious of trachoma is classified under this code.

#### COURSE OF DISEASE

The onset may be either acute with severe subjective symptoms, such as photophobia or severe pain, or it may be gradual. The disease as seen during the first week is characterized by a generalized redness of the bulbar conjunctiva, with lacrimation. Occasionally, secretion is present, and the lids frequently stick together. Photophobia is invariably present. Within one to two weeks from the onset, a few tiny white follicles can be seen scattered over the tarsal conjunctiva in the region of the retrotarsal fold. At this time, with the aid of the corneal microscope, a beginning extension of the blood-vessel loops can be observed, extending from the upper part of the limbus downward into the cornea. As the disease progresses and more follicles are seen on the tarsal conjunctiva, there may also be seen an extension of the pannus and the presence of subepithelial infiltrates, especially in the clear part of the cornea which is free of blood vessels.

During the entire course of the disease minute punctate epithelial lesions may be seen, which stain with fluorescein. This description would refer to *Code I*. It is during this stage of the disease that inclusion bodies are found in the epithelial scrapings of the conjunctiva more frequently than in any other stage. As the disease progresses the follicles increase in number and size. The condition is now to be classified as beginning *Code II*. Distinct follicles are difficult to see because

of the marked papillary hypertrophy. There are several small conjunctival elevations having irregular surfaces, giving the tarsal conjunctiva a rough appearance. A further characteristic of this stage is the readily distinguishable pannus, which is more easily recognized. The subjective symptoms are usually more severe but these vary with each case.

The next development is the cicatrization of the conjunctiva, and it is this scarring which forms the basis for the classification of *Code III*. The diagnosis of trachoma is made simple at this stage because of the presence of scar tissue in the form of fine striae covering the hypertrophic conjunctiva. The amount of scarring present depends upon the duration of the disease. The longer the disease has existed the more scar tissue is to be observed. The pannus in this stage is usually increased, and it is possible in some cases to see complete vascularization of the cornea.

Corneal ulcers are a complication and are seen somewhat more frequently at this than at other stages of the disease. The complication of corneal ulcers might be a factor in the marked extension of vessel loops and the vascularization of the cornea. There is more danger of decreased visual acuity from scars resulting from corneal ulcers than there is from the pannus and corneal infiltrates, which to a certain extent clear following treatment with the sulfonamides.

The last stage, or *Code IV*, is the healed stage of the disease. Smooth scar tissue has replaced the papillary hypertrophy and follicles which were present. This laying down of scar tissue frequently causes deformity of the lids, which manifest a tendency to curve inward, leading to irritation of the cornea by the inverted lashes. Deep trachomatous infiltration of the upper lid occasionally causes permanent ptosis. Even though the disease is clinically arrested, one is still able to see



evidence of the pannus, which consists of atrophic vessels. The use of the biomicroscope is usually necessary to see the remains of the pannus.

In sulfonamide-treated cases this cicatrization, which is so typical in the late stages, is diminished or may be absent if the treatment takes place early in the course of the disease.

#### TREATMENT

Prior to the introduction of the use of the sulfonamides in trachoma by the U. S. Indian Service, many different kinds of treatment employed the use of some agent which would hasten the production of scar tissue. Mechanical methods used were scraping of the conjunctiva with a sharp instrument, brushing by means of a toothbrush, expression of follicles, and grattage with a piece of gauze. Massage of the conjunctiva with a cotton applicator soaked in chaulmoogra oil or mineral oil was also used. Instillation of 4-percent copper-sulfate solution, and application of a 1-percent solution of silver nitrate, and many other methods were used. No one method was satisfactory, as was evidenced by the multiplicity of procedures.

Following the successes with the use of sulfanilamide, reported by Loe<sup>20</sup> and Boen-Lian,<sup>21</sup> chemotherapy rapidly replaced former methods of treatment in the Indian Service. Loe used one-third grain of sulfanilamide per pound of body weight, administered daily in divided doses for one week, then one-quarter grain per pound for another two weeks. Hirschfelder,<sup>22</sup> Richards,<sup>23</sup> Forster,<sup>24</sup> and Thygeson<sup>25</sup> also reported good results from the use of sulfanilamide in the treatment of trachoma.

When sulfonamides were first employed in the Indian Service the cases were closely observed by hospitalization. The visual acuity was tested before and after treatment. During the administra-

tion of the drug, daily blood studies were made together with the examination of the urine. Changes in the visual acuity were found generally unreliable as a check in the progress of the treatment, owing to the fact that the examination was conducted in a subjective manner with the possibility of error. However, the acuity of a very large number of patients showed rather marked improvement. When prolonged observation of approximately 1,300 cases had uncovered few significant changes in the blood it was believed that a routine blood examination was not necessary, and studies of this kind were made of only individual cases. Patients were questioned closely regarding any symptoms which might be attributed to the administration of sulfonamides. If the patient became cyanotic or complained of subjective symptoms, the drug was discontinued for a day or two and started again after the symptoms had subsided. When sulfanilamide was given in daily doses of 0.5 gr. per pound of body weight, the blood concentration was over 5 mg. per 100 c.c. In certain cases concentrations of 3 mg. per 100 c.c. In certain cases concentrations of 3 mg. per 100 c.c. had a definite therapeutic effect if used over a period of four to six weeks.

During the past four years over 20,000 patients have been treated, and of these approximately 75 percent were cured with one course of treatment. The remaining 25 percent required a second course of treatment, in all probability because of inadequate dosage or because the drug was not continued long enough. It was found that over 90 percent were cured with one course of treatment when a dosage of 0.5 gr. per pound of body weight was administered over a period of 20 days.

Inasmuch as the disease is localized mainly in the conjunctiva, tarsus, and cornea of the eye, local treatment was

tried on a group of Indian children in the form of a 20-percent sulfanilamide ophthalmic ointment which was used without other treatment. The ointment was placed in the cul-de-sac and massaged for 10 minutes, with the lids closed, three times a day over a period of two weeks. No improvement was observed. Instillation of a saturated solution of sulfanilamide was used in a group of 15 cases, three times daily for a period of one month without other treatment, and this group also showed no apparent improvement following this course of treatment. Busacca<sup>26</sup> also had no success in the use of sulfanilamide locally. Cosgrove<sup>3</sup> made a preliminary report of possibly promising results, using only local therapy, but later advised in a personal communication that satisfactory results were not obtained. Loe<sup>27</sup> stated that he had had excellent results from the use of very finely powdered sulfanilamide applied directly to the lower cul-de-sac. About 2 gr. of powder is placed in the eye and the lacrimal secretion converts this powder into a pastelike roll. This is allowed to remain in the eye for 6 to 12 hours. Loe claims that trachoma can be arrested in one to two months by the use of this method only, although it is more effectively used in conjunction with oral administration of the drug.

There have not been encouraging results from the use of sulfathiazole administered either locally or by mouth. However, Cosgrove<sup>3</sup> reported favorably on this course of treatment. Although trachoma responds to treatment with several of the sulfonamides, sulfanilamide is the preferred drug, from the stand-

point of efficacy and economy.

Physicians of the Indian Service find that the Indian seems to tolerate the sulfonamides much better than does the Caucasian. At present the use of daily doses of from 0.2 to 0.5 gr. sulfanilamide per pound of body weight in divided doses over a period of from 10 to 20 days should be adequate in most cases.

Because of difficulties in the diagnosis of trachoma, cases of folliculosis are occasionally included in a group of trachoma cases. These folliculosis cases show slight or no improvement after a course of sulfonamide therapy. In the studies conducted by the Indian Service any case showing only slight improvement after a proper course of treatment is seriously questioned as to correct diagnosis and is considered more likely to be folliculosis or another external eye disease.

### CONCLUSIONS

1. In a study of trachoma, among the North American Indians, it has been found that there was only a slight decrease in the incidence of the disease between 1912 and 1938, but, following the use of the sulfonamides in 1939, there has been a marked reduction in the incidence.

2. Pannus must be present if the diagnosis of trachoma is made.

3. Local sulfonamide therapy has not been encouraging.

4. Over 90 percent of the patients were cured following one course of treatment, if an adequate dosage of sulfanilamide was employed.

5. Cases not responding to sulfanilamide therapy are probably not trachomatous.

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# REACTIVITY OF THE OCULAR TISSUES TO WETTING AGENTS\*

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Many highly surface-active compounds have been synthesized recently. Even in minute concentrations they lower the surface tension of water and thereby facilitate miscibility of water with water-insoluble substances; that is, wetting. These wetting agents are widely used as substitutes for soap, but also have other properties of importance in ophthalmology. Several are strong antiseptics with high bactericidal power and reportedly low tissue-toxicity;<sup>1,2</sup> consequently, they have been used in treatment of external ocular infections.<sup>3</sup> The combination of detergent and bactericidal action has made them particularly useful in preoperative preparation of the conjunctiva and the skin of the lids, and in sterilization of delicate ophthalmic instruments. Also, aqueous solutions of wetting agents are excellent vehicles for ophthalmic drugs in that they inhibit bacterial and fungal growth and facilitate absorption<sup>†</sup> of certain drugs; for example, carbamylcholine chloride.<sup>4</sup> These agents are also used to stabilize emulsions and suspensions of other ophthalmic drugs; for example, sulfathiazole.<sup>5</sup> Recently, a new class of cycloplegic and mydriatic drugs with the properties of wetting agents has been synthesized by the writer and Norman G. White.<sup>6</sup> These new compounds are surface-active esters of choline, and diethyl-aminoethanol.

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† The facilitation of drug absorption is probably due to increased permeability of the surface epithelium and improved contact between the drug solution and the epithelium.

Considering the numerous applications of wetting agents to ophthalmic therapeutics and the increasing liability of accidental ocular inoculation in the home and industry, investigation of the possible toxic effects of wetting agents on the ocular tissues was considered important. O'Brien and Swan<sup>7</sup> reported that 0.04- to 0.05-percent solutions of zephiran chloride produced superficial punctate disturbances of the epithelium. Otherwise, the effects of wetting agents have received little attention as factors contributing to irritation and injury either from accidental inoculation or after instillation of drug solutions into the conjunctival sac. In fact, manufacturers of wetting agents have stressed their low tissue toxicity.<sup>2</sup>

Over a period of five years, wetting agents were administered by the author to hundreds of patients in the Eye Clinic of the State University of Iowa. Many of these patients received only single instillations of the drugs, whereas a few have received instillations two to four times daily for as long as three years. Tolerance to the drug solutions was determined by repeated examinations of the conjunctiva and cornea by slitlamp biomicroscopy. In addition, patients were questioned regarding irritation. The studies were made with zephiran, duponol, phemerol, aerosols, and several other wetting agents, including the new class of short-acting cycloplegic and mydriatic drugs.

Strong solutions of wetting agents—that is, 0.1-percent zephiran chloride—produced a characteristic conjunctival reaction. Following instillations of a single drop (0.50 c.c.) into the conjunctival sac

of human volunteers, hyperemia and edema of the conjunctiva developed. Lacrimation was profuse. Slitlamp examination revealed thickening and decreased transparency of the superficial layers of the conjunctiva associated with

the desquamated epithelium often became rolled into strands of sufficient size and consistence to create a foreign-body sensation.

Characteristic corneal lesions occurred also. Within 90 seconds after instillation

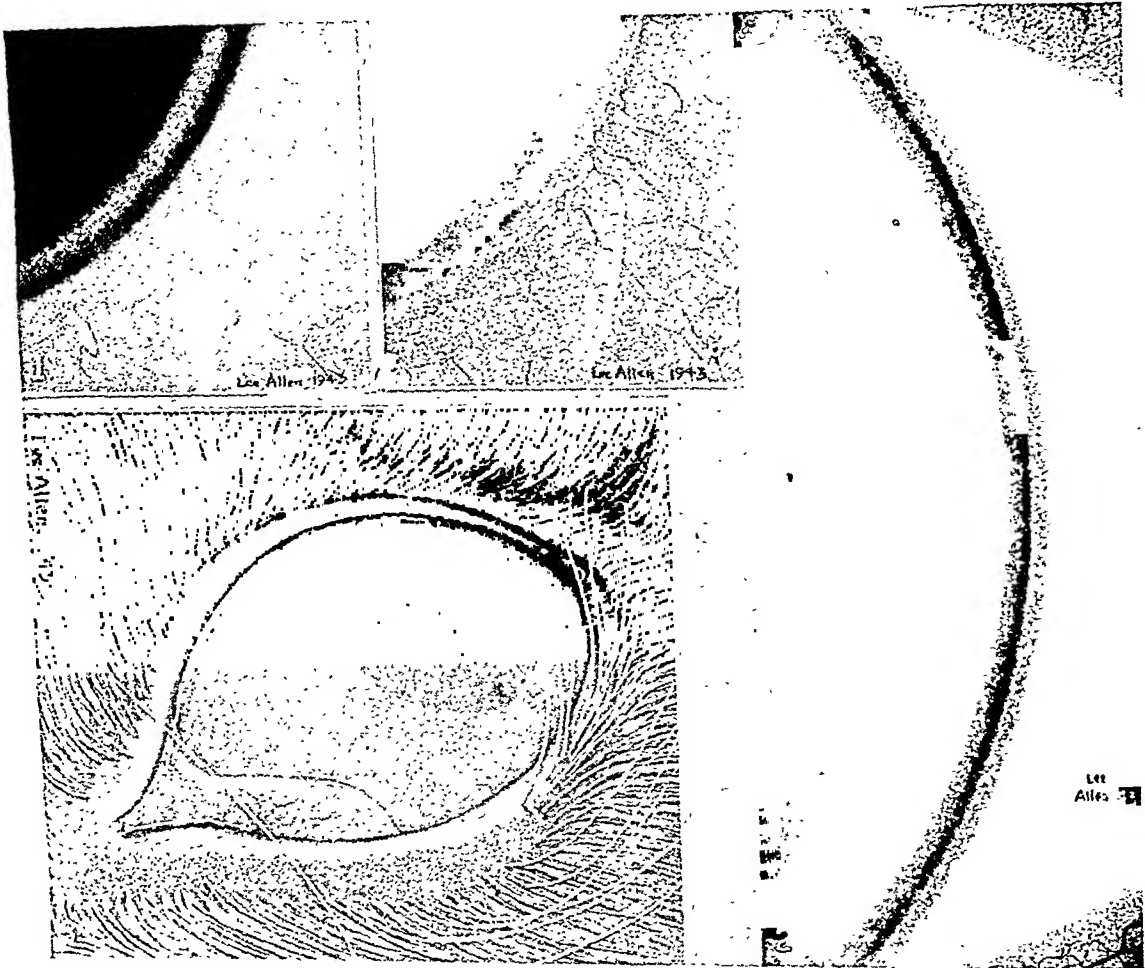


Fig. 1 (Swan). Biomicroscopic appearance of normal conjunctiva: a, after instillation of 0.1-percent zephiran; b, the conjunctiva is edematous and hyperemic.

Fig. 2. Superficial punctate lesions of the corneal epithelium produced by wetting agents.

Fig. 3. Tremendous edema of rabbit's cornea 14 hours after injection of a wetting agent into the anterior chamber.

marked dilatation of the superficial capillaries (fig. 1). Engorgement of the deeper and larger conjunctival vessels followed in some individuals. Frequently, actual desquamation of the conjunctival epithelium occurred either as pseudomembranes or as strands or clumps of clear, tenacious discharge. In the lower fornix,

of a drop of 0.1-percent zephiran chloride, multiple, punctate, gray areas in the corneal epithelium were evident with the aid of the biomicroscope (fig. 2). These tiny areas gradually became confluent, and within 10 minutes could be seen with the naked eye as a gray haze in the corneal surfaces. Roughening and drying of the

epithelium, such as is noted after instillations of topical anesthetics, did not occur. A similar but much less severe disturbance of the corneal epithelium was seen in the corneas of several patients who had been instilling 0.03- to 0.04-percent zephiran solution into their conjunctival sacs three to four times daily over periods of from two to eight weeks. These patients complained of the sensation of sand in their eyes. Recovery was rapid in all cases. In most, the conjunctiva and cornea returned to normal within 12 hours.

Individuals varied in their sensitivity to solutions of wetting agents; however, no evidence of idiosyncrasy was observed nor total lack of reactivity in individual patients. There was, moreover, some difference in the intensity and duration of irritation produced by the different wetting agents, even in solutions having the same air-water interfacial tension. The surface tension of solutions is not directly proportionate to the concentration of the wetting agent; therefore, dilution by tears and conjunctival secretion does not have an equal effect on the surface activity of all wetting agents. However, determination of the air-water interfacial tension provided some index as to whether a solution containing a surface-active compound would be irritating. When the pH of the solution was neutral (pH 6.5 to 7.5) and the solution isotonic,\* concentrations of wetting agents which lowered the surface tension at air-water interface to less than 37 dynes per centimeter at 25 degrees and which maintained a surface tension below 40 dynes despite dilution of several times, were consistently described as irritating although objective changes could not always be observed.

The effects of wetting agents seemed

cumulative. A single instillation was often well tolerated whereas a second or third instillation at short intervals produced discomfort and objective signs of irritation. A number of external inflammations was observed to be aggravated by too frequent instillations of wetting agents administered as bactericidal agents. It is important, therefore, to limit the frequency of administration of wetting agents to a few instillations daily until the patient's tolerance is established.

The injurious effects of solutions of wetting agents instilled into the conjunctival sac seemed limited to the most superficial layers of the cornea and conjunctiva, even when repeated instillations were made. One-tenth-percent solutions of phemerol and zephiran were instilled into the conjunctival sacs of rabbit eyes two to three times daily for periods of one to three months. The corneal epithelium became thickened, rough, and superficial vascularization developed, but no damage to the deeper layers of the cornea or to the intraocular tissues was noted by either slitlamp biomicroscopy or microscopic study of stained sections. Even when undissolved aerosol OT was placed directly on the cornea, the inflammatory reaction was limited to the superficial layers.

The skin of the lids was less readily irritated by wetting agents than was the conjunctiva, but even so was more sensitive than skin elsewhere on the body. Concentrations advocated by the manufacturers for use on the skin occasionally produced irritation of the lids.

It was considered desirable to investigate the effects of wetting agents on the intraocular tissues for several reasons. It was thought that because of their advertised low tissue-toxicity and high bactericidal action, wetting agents could possibly be added to solutions used for irrigation of the anterior chamber to lessen

\*The hydrogen-ion concentrations of the various solutions were determined with a glass electrode in all instances. Osmotic-pressure measurements were made by the vapor-pressure method.

the danger of postoperative infections in ophthalmic surgery or to treat anterior-segment infections. Also, accidental intraocular inoculation of wetting agents might occur in industry or in instances where solutions of these agents were carelessly used to prepare the conjunctival sac or sterilize instruments for intraocular surgery.

To determine the influence of wetting agents on the intraocular tissues, the anterior chambers of albino-rabbit eyes were irrigated with 0.68-percent sodium chloride containing known concentrations of wetting agents. Limbic punctures were made with two, sharp 27-gauge needles so joined by a syringe system that as aqueous was withdrawn into one syringe an equal quantity of the test solution was injected from the other. By this technique it was possible to control the concentration of the wetting agent in the anterior chamber without incurring the reaction which follows emptying of the anterior chamber or gross alterations in intraocular pressure. Slitlamp studies when sodium fluorescein was added either to the test solution or injected intravenously indicated that the test solutions permeated to all parts of the anterior chamber and replaced most of the normal aqueous.

Control injections made with 0.68-percent sodium chloride were found to create a mild iridocyclitis, but after 24 hours there was no evidence of inflammation provided the iris had not been touched by the needles. In contrast, minute concentrations of wetting agents—for example, 0.025- to 0.050-percent zephiran—resulted in a violent reaction in the rabbit eye. Slitlamp biomicroscopy revealed a swollen, gray corneal endothelium and in some instances vesicles were observed to form and rupture, leaving Descemet's membrane exposed. There were marked engorgement of the iris vessels, edema of the iris stroma, and a profuse outpouring

of fibrin and protein into the anterior chamber. The suture markings on the aqueous surface of the lens became prominent, but no definite lens opacities developed. Within 12 hours, the corneal stroma became edematous and the epithelium bedewed (fig. 3). The acute inflammatory process in the iris usually subsided over a period of a few days to a week, although in several instances degeneration or secondary glaucoma followed. The cornea seldom returned to normal and in many instances became opaque and vascularized. The reaction in the intraocular tissues appeared proportionate to the concentration of the wetting agent in the anterior chamber, for example, concentrations of 0.05-percent zephiran or phemerol were almost always followed by serious sequelae whereas the eye generally recovered from concentrations of 0.01 percent.

## DISCUSSION

The minimal concentrations of wetting agents producing irritation in the conjunctival sac are greater than those that are effective therapeutically. For example, Allen<sup>8</sup> found that concentrations of 0.002-percent zephiran inhibit the respiration of hemolytic staphylococci of known ocular pathogenicity\* but concentrations as high as 0.025 percent were tolerated in the conjunctival sac. The concentrations necessary to facilitate absorption of drugs from the conjunctival sac or added to ointments or emulsions to produce stability and smooth preparations are also less than those producing irritation with a single administration. Most of the surface-active mydriatic and cycloplegic drugs developed by Swan and White are generally not irritating in therapeutic doses. In fact, one of these

\* In combination with inorganic mercurials, the minimal effective bactericidal concentration of zephiran was found to be even more dilute.



new drugs, dibutoline, has been proved effective in allaying anterior-segment inflammations.<sup>9</sup>

### SUMMARY AND CONCLUSIONS

Although low tissue-toxicity of wetting agents has been stressed in the literature and commercial advertisements, these surface-active compounds are capable of producing reactions in the ocular tissues. Surface activity must therefore be added to variations in pH and osmotic pressure as possible reasons for irritation from ophthalmic medicants. The surface tension (air-water interface) of a given drug solution provides some evidence as to whether a wetting agent is present in sufficient concentration to produce irritation in the conjunctival sac.

In the conjunctiva and corneal epithelium, wetting agents produce characteristic reactions that are greatly increased by

frequent or prolonged administration. Although superficial and transitory, these reactions are distressing to patients. Fortunately, the concentrations producing irritation in the conjunctival sac are usually greater than the minimal effective therapeutic concentrations, provided the solutions are not administered too frequently.

Wetting agents injected into the anterior chamber in minute concentrations produce violent reactions. The endothelium of the cornea seems particularly susceptible to damage. Care must be taken to avoid accidental intraocular introduction when these agents are used in sterilization of instruments for intraocular surgery, in preoperative preparation of the conjunctival sac, or in treatment of penetrating wounds.

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# RECESSION OF THE TROCHLEA FOR REDUCING THE ACTION OF THE SUPERIOR OBLIQUE MUSCLE\*

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Overaction or spasm of the superior oblique muscle is often secondary to a congenital paresis or paralysis of the associated inferior rectus muscle of the opposite eye. Sometimes, however, no such paresis can be demonstrated. The principal manifestation is a downshoot of the eye when it is rotated into the nasal field (nasal rotation is, of course, by the action of the medial rectus). This is comparable to the upshoot in the nasal field in spasm of the inferior oblique muscle. Concerning the latter condition, whether primary or secondary, there is general unanimity of opinion that the most satisfactory treatment is an operation designed to weaken the elevating effect of the overactive muscle, such as tenotomy, myectomy, or recession of the inferior oblique.

An operation designed to weaken the depressing effect of the superior oblique muscle when overactive was reported in 1942.<sup>1</sup> Two cases were reported at that time. The purpose of the present paper is to present further data on six additional cases in which the patients have been operated on since the original presentation.

The surgical procedure was reported in full and illustrated by diagrams and drawings.<sup>1</sup> A skin incision is made down to the periosteum in the upper nasal angle of the orbit, and the periosteum is incised along the orbital margin in the region of the trochlea, which is about 0.5 cm. nasal to the supraorbital notch. A lacrimal speculum aids in the exposure and in the control of hemorrhage.

The supratrochlear branch of the

supraorbital nerve runs above, and the infratrochlear branch of the nasociliary nerve crosses the orbital margin below, the trochlea. Both of these branches are usually cut across in making the incision down to the bone.

The periosteum, which, in the region of the attachment of the trochlea is densely adherent to the bone, is then undermined posteriorly on the roof of the orbit in this area for a distance of about 1.5 cm. Two incisions are carried posteriorly, one from each end of the marginal incision in the periosteum, to free the three margins of the periosteal flap to the anterior free end of which the trochlea is attached. The skin incision is closed in the usual manner. The trochlea can then be pushed posteriorly by means of a small, tightly wound roll of gauze placed over the wound and held in place for two to four days by means of a pressure dressing. This pledget is placed so as to localize the pressure directly over the region of the trochlea, thus aiding in its retroplacement. The tension of the muscle itself also aids in pulling the unattached trochlea posteriorly. After two or three days, only a light dressing is necessary.

The recession of the trochlea thus produced has a double effect, one on the tendon and one on the muscle itself, each contributing to the reduction in the effectiveness of the action of the superior oblique muscle on the eye.\*

\* Presented at seventy-ninth annual meeting of the American Ophthalmological Society at Hot Springs, Virginia, June, 1943.

\* In discussing this procedure privately Dr. Smart, U.S.N., suggested that a third reason for the reduction in the effectiveness of the muscle might be the change in the direction of the pull of the tendon in relation to the eye effected by the change in position of the trochlea.

## CASE REPORTS

**CASE 1.** The first patient was operated on in 1935. Report follows: Mr. R. B., aged 16 years, since childhood had tilted his head, and had diplopia when looking to the left and down with the head held upright. Pictures taken when he was quite young show the head tilt clearly (figs. 1 and 2).

Vision was 20/20 with each eye; the

*Diagnosis.* Exotropia (convergence insufficiency) with overaction of the right superior oblique, producing the right hypotropia (head upright) and extorsion of the right image.

The operation, previously described, was performed, combined with subconjunctival tenotomy of the lateral rectus muscle. Two months postoperatively the patient reported complete comfort. In di-



Figs. 1, 2, 3 (Hughes). Case 1. Fig. 1. Preoperative photograph showing head tilt in very early childhood. Fig. 2. Preoperative photograph showing continued head tilt throughout childhood. Fig. 3. Postoperative photograph showing absence of head tilt after surgery, recession of the trochlea.

(cycloplegic) refractive error was +1.50D. sph. O.U.

*Muscle balance.* With the head held upright there was a noncomitant exotropia of 8.00<sup>A</sup>, with a somewhat variable right hypotropia of 8.00<sup>A</sup> at 20 feet, and exotropia of 15.00<sup>A</sup> and right hypotropia of 8.00<sup>A</sup> at 13 inches. Fusion could be attained by tilting the head down and to the left. Diplopia plotting (fig. 4) with the head held straight and the left eye fixating, showed the right image to be higher in the primary position of gaze, with the vertical separation of the images increasing when the eyes looked down and to the left. There was gross fusion in other directions of gaze.

rect gaze the head was held upright; no diplopia was present (fig. 3). Esophoria of 1.00<sup>A</sup> at 20 feet and exophoria of 4.00<sup>A</sup> at 13 inches were noted. The diplopia field showed only a slight elevation of the right image with the eyes down and to the left (fig. 5).

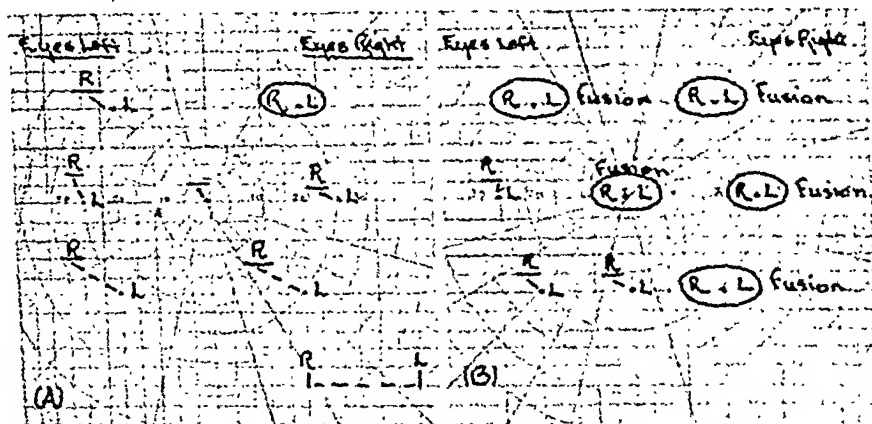
**CASE 2.** The patient in this case was seen by the present writer in consultation and was operated on by Dr. Donald W. Bogart.

Miss E. S., aged 26 years, had a strabismus of long standing for which she had had an operation; she could not read for any length of time or do work of any type requiring prolonged use of the eyes, and noticed diplopia when tired. With the

head straight there was a vertical separation of images; the right image being higher (fig. 9). This could be temporarily corrected by tilting the head to the left and down.

Vision was 20/20 with each eye. The refractive error was: O.D. +0.75D. sph.  $\ominus$  -0.87D. cyl. ax. 12°; O.S. +1.50D. sph.  $\ominus$  -0.75D. cyl. ax. 175°.

although the measurements were not altogether satisfactory. Diplopia plotting with the head held upright was done, showing diplopia in all positions of gaze, with the right image higher than the left. The vertical separation of the images was greater with the eyes looking down and left (fig. 9). The left was the fixating eye. Slight hypotropia in the primary position,



Figs. 4, 5 (Hughes). Case 1. Fig. 4. Preoperative diplopia plotting. Fig. 5. Postoperative diplopia plotting.



Figs. 6, 7, 8 (Hughes). Case 2. Fig. 6. Preoperative photograph showing vertical deviation with head held straight. Fig. 7. Preoperative photograph showing dowshoot of right eye on looking down and to the left. Fig. 8. Postoperative photograph showing improvement in position of eyes looking down and to the left after surgery, recession of the trochlea.

**Muscle balance.** With the head held upright, a noncomitant exotropia of 6.00<sup>A</sup> and a variable right hypotropia of 4.00<sup>A</sup> to 6.00<sup>A</sup> was noted at 20 feet, and 2.00<sup>A</sup> of esotropia and 4.00<sup>A</sup> to 6.00<sup>A</sup> of right hypotropia at 13 inches. An extorsion of the right image of 12 degrees was found on the synoptophore. With the head tilted left and down, and with effort, third-degree fusion was temporarily possible for short periods. Examination for aniseikonia was made and no size difference of the retinal images was demonstrable,

and dowshoot on looking nasally, are shown in figures 6 and 7.

**Diagnosis.** Postoperative convergence excess, and overaction of the right superior oblique.

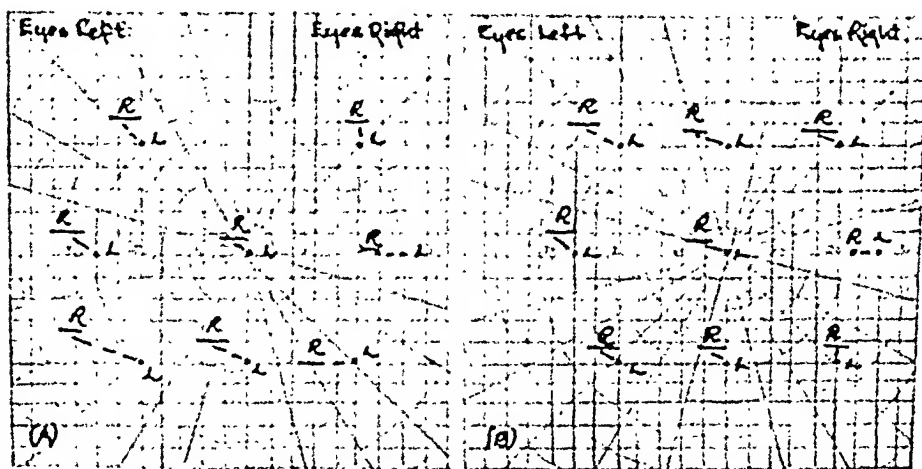
The preoperative diplopia fields are shown in figure 9. The right trochlea was recessed in the manner described. Postoperatively the patient was followed for two years, and reported nearly complete comfort for the first time in years, being able now to carry out normal secretarial work. In direct gaze, with the head held

upright, there was an exophoria of 10.00<sup>d</sup> with 3.00<sup>d</sup> of left hyperphoria (with the Maddox rod over the right eye) present at 20 feet, and an exophoria of 5.00<sup>d</sup> with 3.00<sup>d</sup> of left hyperphoria at 13 inches. Residual extorsion of the right image of 3 to 4 degrees was found on using the synoptophore. The plotting of the post-operative diplopia field is shown in figure 9. Third-degree fusion could be maintained easily with the head held normally,

of 5½ years, a more comprehensive examination could be carried out. The patient was nervous, and speech was quite hesitant.

Vision was good with each eye, 20/20, and the fusion was normal.

Muscle balance in the primary position showed an exophoria of 1.00<sup>d</sup> for distance and exophoria of 12.00<sup>d</sup> for near and right hyperphoria of 1.00<sup>d</sup>. In the primary position the eyes were straight, but on

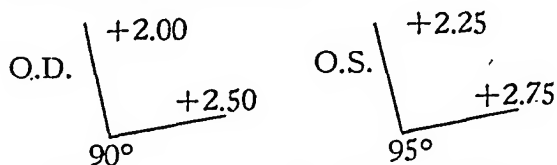


Figs. 9, 10 (Hughes). Case 2. Fig. 9. Preoperative diplopia plotting. Fig. 10. Post-operative diplopia plotting.

and near work could be done for long periods. The lack of overaction of the right superior oblique is shown in figure 10.

The successful result in each of these two cases encouraged further trial of the procedure. It was subsequently carried out in six more cases, the reports of which follow:

CASE 3. Wayne L., aged 9½ years, was first seen in 1935, at the age of 1½ years. His mother thought the eyes were crossed. Coöperation was difficult to achieve, but no deviation was noticed. Very little refractive error was found. Retinoscopy showed the following:



When next seen, in 1939, at the age

looking to the right, there was a marked downshoot of the left eye with defective depression of the right eye in its associated temporal field. This indicated a paresis of the right inferior rectus with secondary spasm of the left superior oblique. There was also defective elevation of the left eye in its temporal field with an extreme upshoot of the right eye in its nasal field caused by a congenital paresis of the left superior rectus with secondary spasm of the right inferior oblique muscle.

Exercises were prescribed in an attempt to move the eyes with the parietic muscles into the fields in which their movements were limited.

The patient was seen at intervals of a few months during which there was no essential change in the condition. In August, 1942, the complaints were: difficulty with reading, slow rate and confusion of letters in small words; diplopia

on looking away from the primary position.

The extraocular rotations were the same as in 1939. The patient was left-handed and right-eyed.

On August 19, 1942, a recession of the left trochlea and a myectomy of the right inferior oblique muscle were performed.

On December 9, 1942, there was no upshoot of the right eye on rotation into its nasal field and no downshoot of the left eye on nasal rotation.

Muscle balance tests showed an exophoria of  $6.00^{\Delta}$  for distance and  $10.0^{\Delta}$  for near and left hyperphoria of  $10.00^{\Delta}$ . There was diplopia which was fairly comitant, and fusion was obtained with the following prescription: O.D.  $+0.25$ D. sph. = 20/20; O.S.  $+0.25$ D. cyl. ax.  $82^{\circ}$  = 20/20; O.D.  $2.00^{\Delta}$  base up  $\approx 2.00^{\Delta}$  base in; O.S.  $2.00^{\Delta}$  base down.

The patient had been wearing this correction for the past two months, and with the glasses on there was no diplopia. He had shown considerable improvement in school and his nerves were much calmer and speech better than at any time previously. The mother was much pleased with the marked change in behavior and in the improvement in his school work as well as in the appearance of the eyes.

CASE 4. Mr. Charles F., Jr., was first seen in September, 1933, at 39 years of age. He complained of headaches, and extreme divergent strabismus.

He had worn glasses from early childhood. The left eye became divergent after an attack of whooping cough at two years of age. Vision of the left eye had always been poor. He had had three operations for divergent strabismus when he was eight and nine years of age.

Refractive error was: O.D.  $+0.37$ D. sph.  $\approx -0.62$ D. cyl. ax.  $110^{\circ}$  = 20/15; O.S.  $+1.00$ D. sph.  $\approx -0.62$ D. cyl. ax.  $75^{\circ}$  = 20/25.

*Muscle balance.* A marked exotropia

was present, measuring  $47.00^{\Delta}$  for distance and  $55.00^{\Delta}$  to  $65.00^{\Delta}$  on fixation at 33 cm. There was also a left hypotropia of  $10.00^{\Delta}$  in the primary position, increasing in the lower right field to  $20.00^{\Delta}$  to  $30.00^{\Delta}$ . There was a marked downshoot of the left eye on looking to the right. Some limitation of motility of the left eye nasally due to weakness of the left medial rectus was present.

When next seen in March, 1942, the conditions were identical and the patient was desirous of having the eyes straightened.

A resection of the left medial rectus and complete tenotomy of the left lateral rectus together with a recession of the trochlea of this eye were performed.

Subsequent to this operation there was still some exotropia, which was at times an exophoria; with the aid of prisms fusion could be obtained, but was maintained with difficulty. Exercises on the stereoscope helped only slightly. There was an exotropia of  $20.00^{\Delta}$  with a right hypertropia of  $4.00^{\Delta}$  increasing in the upper right field due to overaction of the right superior rectus muscle.

A subconjunctival complete tenotomy of the right lateral rectus and a partial tenotomy of the right superior rectus were performed.

Following this operation there was a residual exophoria of  $6.00^{\Delta}$  and right hyperphoria of  $2.00$  to  $3.00^{\Delta}$ . The patient was able to fuse easily with the following lenses, which gave him 20/20 vision in each eye: O.D.  $-0.25$ D. sph.  $\approx +1.00$ D. cyl. ax.  $15^{\circ}$ ; O.S.  $+0.75$ D. sph.  $\approx +0.50$ D. cyl. ax.  $160^{\circ}$ ; O.D.  $2.00^{\Delta}$  base in  $\approx 1.00^{\Delta}$  base down; O.S.  $2.50^{\Delta}$  base in  $\approx 1.00^{\Delta}$  base up; add  $+1.00$ D. sph. for near.

The hyperexophoria was now comitant. Of particular interest for the purpose of this paper is the fact that the marked downshoot of the left eye on nasal rota-

tion was eliminated by the recession of the trochlea of this eye.

CASE 5. Theresa G., aged 15 years, was first seen at the clinic of the New York Eye and Ear Infirmary on November 21, 1941. There was a history of having had "crossed eyes" since infancy, and she would like to have eyes straightened. Glasses had been worn for many years, but they had made no improvement in the position of the eyes.

*Muscle balance.* Examination revealed an esotropia of 40.00<sup>A</sup> for distance with slight increase for near. In the primary position there was a right hypertropia of 3.00<sup>A</sup> which became a right hypotropia of 10.00<sup>A</sup> to 15.00<sup>A</sup> on looking to the left and down, there being a downshoot of the right eye in its nasal field. No limitation of motility of the left eye could be demonstrated.

Estimation of the refractive error under cycloplegia showed a hyperopia of +2.00D. with corrected vision of 20/30 in each eye.

An operation to straighten the eyes was decided upon, and a recession of the right medial rectus (4 mm.), a resection of the right lateral rectus (4 mm.) combined with a recession of the trochlea of the right superior oblique, were carried out on February 2, 1942.

Following these procedures there was still an esotropia of 28.00<sup>A</sup> and a right hypertropia in the primary position of about the same degree as previously reported. There was less downshoot of the right eye on nasal rotation, but it was still present.

In this case only a partial result (about 50 percent) was obtained in the correction of the horizontal and vertical deviations.

CASE 6. Miss Jane R. was first seen when she was 17 years of age, on April 8, 1942, with a history of strabismus since the age of 20 months. An operation had

been performed on each eye five years previously, and there had been double vision ever since.

The patient had two sisters, one 13 years of age, with a convergent strabismus, and one of 8 years whose eyes were said to be straight.

*Vision* (with present glasses) was 20/30+ with the right eye and 20/20+ with the left.

The result of estimation of error of refraction by manifest follows was: O.D. +2.00D. sph.  $\approx$  +0.50D. cyl. ax. 115° = 20/25-; O.S. +2.00D. sph.  $\approx$  +0.50D. cyl. ax. 60° = 20/15.

On accommodation the patient read 0.5 mm. type (punctum proximum 120 mm.) with each eye. Under cycloplegia an additional 1.00D. of hyperopia was uncovered. There was anomalous retinal correspondence. Subjective tests with the Maddox rod revealed a diplopia neutralized by about 8.00<sup>A</sup> base out, while alternate cover test in the primary position showed an esotropia of 15.00<sup>A</sup> for distance and 20.00<sup>A</sup> for near with a variable right hypotropia. On looking to the right the esotropia increased while on looking to the left there was an exotropia, due apparently to contracture of the right medial rectus muscle. There was a right hypotropia which increased markedly on looking to the left, denoting overaction of the right superior oblique. There was possibly a slight limitation of elevation nasally of each eye. No limitation of motility of the left eye was demonstrated on looking down in either the nasal or the temporal field.

Measurements for aniseikonia were attempted, but could not be accurately carried out on account of the defective fusion.

On January 14, 1943, a partial tenotomy of the right medial rectus and a recession of the right trochlea were performed. On March 31, 1943, there was

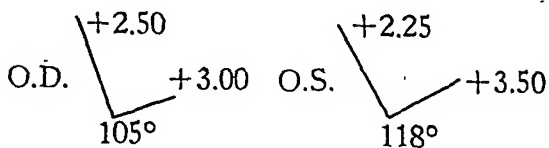


still an esotropia of 12.00<sup>A</sup> for distance and 14.00<sup>A</sup> for near without correcting lenses. With glasses on the patient had a slight exotropia for distance and an esotropia of 8.00<sup>A</sup> for near. She said she had been able to carry on with her college studies much better than previously. There was still only very rudimentary fusion demonstrable on stimulation on the synoptoscope. There was still some downward deviation of the right eye in its nasal field. Anesthesia in the right brow region was due to accidental severance of the supraorbital nerve.

CASE 7. Marilyn V., was six years of age when first seen on February 4, 1941. The history related that the eyes had been crossed since the child was two years of age. The mother thought it was less noticeable now than formerly.

Vision was 20/30 with the right eye and 20/100 with the left, and was unimproved by lenses. She could read 0.5-mm. type with the right eye and 4.2-mm. type with the left. There was an esotropia of 22.00<sup>A</sup> for distance and for near with no vertical deviation in the primary position. On the synoptoscope no fusion could be demonstrated, the left image being suppressed.

Retinoscopy under three drops of homatropine hydrobromide 5 percent was as follows:



The media and fundi were negative. Atropine sulphate 1 percent to be used once daily and a plano lens were prescribed for the right eye, with the following lens for the left: +0.25D. sph.  $\approx$  +1.25D. cyl. ax. 115°. An occluder was also given for the right eye to be worn eight hours daily.

Three months later, May 13, 1941, the vision with the glasses as prescribed was 18/200 with the right eye (atropine) and

20/25+ with the left. A prescription was given for the right lens, +0.75D. sph.  $\approx$  +0.50D. cyl. ax. 95° to replace the plano lens. The amount of deviation was unchanged but the child was now fixating with the left eye.

Two months later, July 1, 1941, the vision was 20/20 with each eye when correcting lenses were worn. No change was made in the lenses and the atropine was discontinued. When the patient was seen on April 6, 1942, the vision was 20/50 with the right eye and 20/20 with the left.

Atropine (without occlusion) was prescribed for the left eye, and two months later the corrected vision was again 20/20 with each eye. Rudimentary fusion was demonstrable, diplopia was demonstrable with a red glass over one eye with superimposition of the images in the synoptoscope at the objective angle.

The esotropia was the same as before and a left hypertropia of 2.00<sup>A</sup> was detected for distance, but none at near range. In August, 1942, a left hypertropia of 2.00<sup>A</sup> for distance and 4.00<sup>A</sup> for near was elicited. There was a definite downshoot of the right eye as it was rotated into the nasal field, with no demonstrable limitation of motility of the left eye. An operation to correct the deviation was advised in August, 1942, but was not carried out. When next seen in January, 1943, the best vision obtainable with the left eye was 20/40.

Atropine drops daily were ordered for the right eye with a plano lens, and two months later the vision of the left eye was again 20/20.

On March 11, 1943, a recession of the left medial rectus of 4 mm. and a recession of the right trochlea were performed.

On April 6, 1943, fusion was difficult to obtain, but at the deviation the patient could superimpose images. There was an esotropia of 10.00<sup>A</sup> to 12.00<sup>A</sup>, with a right hypertropia of 2.00<sup>A</sup> to 3.00<sup>A</sup>. The devia-

tion was almost entirely comitant with a possible slight downshoot of the right eye still remaining in extreme rotation down and nasally.

Estimation of the error of refraction under cyclopegia revealed: O.D. +0.37D. sph.  $\approx$  +1.00D. cyl. ax.  $78^\circ = 20/20$ ; O.S. +1.00D. sph.  $\approx$  +1.50D. cyl. ax.  $110^\circ = 20/20$ —.

The improvement in the downshoot on nasal rotation in this case as a result of the recession of the right trochlea was between 75 to 80 percent.

CASE 8. Mrs. John S., 24 years of age, was first seen on March 12, 1943, when she complained of a pulling sensation in the left eye.

The vision of the right eye was 20/15 and of the left was 20/100 unimproved with lenses. Test of accommodation revealed ability to read 0.35-mm. type with the right eye and 2.08-mm. type with the left eye, with a punctum proximum 120 mm. with each eye.

Estimation of the error of refraction by manifest and under a cycloplegic revealed the following: O.D. +0.50D. sph. = 20/15; O.S. +0.75D. sph.  $\approx$  +1.25D. cyl. ax.  $70^\circ = 20/100$ .

There was an esotropia of 20.00<sup>A</sup> for distance and 35.00<sup>A</sup> for near with a right hypotropia of 10.00<sup>A</sup> in the primary position. With her glasses (which agreed with the above measurements) there was very little change in the deviation, but under cyclopegia the esotropia increased to 40.00<sup>A</sup> and 60.00<sup>A</sup> for distance and near, respectively. On rotation to the left the right hypotropia became much more marked when she fixated with the left eye. There was a suggestion of weakness of the left inferior rectus muscle with a definite downshoot of the right eye in its nasal field.

The patient was very anxious to have the eyes straightened surgically. On March 16, 1943, a recession of the left medial rectus of 4 mm., a resection of the left

lateral rectus of 8 mm., and a recession of the trochlea of the right eye were performed.

On April 23, 1943, the measurements for the extraocular muscles revealed an esotropia of 5.00<sup>A</sup> for distance and 0.00<sup>A</sup> for near, with a left hypertropia of 1.00<sup>A</sup> with no change in any of the cardinal positions of gaze.

When she had been back at work for four and a half months the favorable result was still maintained.\*

### DISCUSSION

A simple method of reducing the depressing effect of the superior oblique muscle has been described. Experience with a series of eight cases demonstrates that the results are favorable and complications are practically non-existent.

There is some temporary anesthesia in the area of distribution of the supratrochlear and infratrochlear nerves, and occasionally over the area supplied by the supraorbital branch of the ophthalmic division of the trigeminal nerve, if this nerve should be severed accidentally while incising the periosteum along the orbital margin.

It is barely possible that if the roof of the orbit were very thin it might be injured or perforated when the periosteum is being elevated. With moderate care and skill this should, of course, never occur, since the only place where the periosteum is very adherent is at the point of attachment of the trochlea, near the orbital margin where the bone is quite thick. It is theoretically possible that a complete paralysis of the superior oblique might result, but in none of the cases has this occurred. In some of the cases only a partial correction was obtained.

The question of injury to the eye from a pressure dressing for two to four days

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\* The patient was seen again in July, 1944, and the findings were the same as in April, 1943.

has been suggested.<sup>3</sup> The same amount of pressure is used for a short period as is ordinarily used in most plastic cases involving the lids for a much longer period with no eye damage. In fact the pressure is particularly applied over the region of the trochlea rather than over the entire eye in this dressing. It is conceivable that extreme pressure might injure the eye, but with ordinary care no damage can result in the short period of two to four days in which the pressure is necessary. The hemorrhage that occurs during the first part of the incision down to the periosteum is usually profuse and must be controlled before proceeding to the periosteal incision. It is frequently necessary to use ties for the vessels in this vascular region.

The cases must, of course, be carefully chosen and the operation performed only in those in which the overaction of the superior oblique is quite definite.

#### SUMMARY

Further experience with the recession of the trochlea in six more cases of overaction of the superior oblique is reported—eight cases in all. In several of the cases the results were marked whereas in three of the cases there was 50- to 75-percent reduction of the downshoot due to overaction of the muscle.

The procedure recommended is simple, effective, and safe, and can be done under general or local anesthesia. By placing the trochlea more posteriorly the effectiveness of the contracting muscle is reduced by relaxing it, and, by bringing this point from which the tendon acts more posteriorly and therefore toward the insertion of the tendon on the eye, the pull

is lessened by relaxation of the tendinous portion as well.

There is, therefore, a double effect produced by relocation of the trochlea, one on the muscle and the other on the tendon (see footnote on page 1123). The normal tonicity of the muscle belly aids in pulling the trochlea backward, and it is held there by the pressure from in front.

An operation to advance the associated inferior rectus muscle has been regarded as the operation of choice in cases of superior-oblique spasm especially when associated with a demonstrable paresis of the former muscle. This, in my hands, has left much to be desired, since the main abnormality in motility in most of the cases above reported was the marked downshoot on nasal rotation. In only a few of the cases was any limitation of depression in the field of action of the associated inferior rectus demonstrable. In some cases the spasm may have been primary rather than secondary.

It was evident that some procedure to weaken the action of the overactive superior oblique similar to the operation to weaken the overactive inferior oblique in cases of spasm of this muscle would be the logical procedure. It is felt that the results have justified this assumption that the relocation of the trochlea would eliminate most, if not all, of the excessive downshoot in these cases, and this procedure is recommended for further study in carefully chosen cases of spasm of the superior oblique muscle.

It also becomes evident that the effect of the superior oblique muscle could be increased by advancing the position of the trochlea.

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- <sup>3</sup> Daniel B. Kirby, M.D., in discussion at New York Ophthalmological Society meeting.

# CONGENITAL RETINAL FOLDS\*

## REPORT OF TWO CASES

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Owing to the comparative rarity of the condition known as congenital retinal folds and the fact that they are not infrequently confused with remnants of the hyaloid system, it was thought worthwhile to report two cases seen during the past 16 months at the Institute of Ophthalmology.

A congenital retinal fold, or *ablatio falciformis congenita*, is characterized by the appearance in the fundus of a band of grayish-white tissue extending from the disc outward to the periphery. Blood vessels accompany the fold and are often closely intermingled with its substance. As a rule the fold extends to the posterior surface of the lens, which shows subcapsular cataractous changes in the affected region. Usually the fold is seen bilaterally, it being symmetrically disposed, and although any meridian may be involved, by far the greater number are found to extend inferotemporally.

The condition was first reported by Sulzer,<sup>1</sup> in 1888, and since that time some 39 additional cases have appeared in the literature. To Mann<sup>2</sup> and Weve<sup>3</sup> goes the credit for establishing congenital retinal folds as a nosologic entity, and it was the latter who showed that the condition has a definite familial propensity. In the papers of these authors as well as in those of Theodore and Ziporkes<sup>4</sup> and of Gartner,<sup>5</sup> excellent reviews of the literature are to be found.

In those cases which have been examined pathologically, the fold has been com-

posed of a reduplication of retinal elements, but the pigment epithelium is spared. Rosettes are frequently present, and there is, as a rule, imperfect differentiation of the retinal layers. Usually, the hyaloid artery, either the principal trunk or one of the *vasae hyaloideae propriae*, is attached to the fold or else embedded firmly in its substance. The poor differentiation of the retinal tissue is not confined to the region of the fold alone, but the entire retina is involved, thus indicating a growth disturbance in which the inner layer of the optic cup in its entirety is affected.

The mechanism of production of congenital retinal folds has not been completely elucidated, but Mann<sup>2</sup> has given a plausible explanation which has seen wide acceptance. She believes that at about the 13-mm. stage the vascular primary vitreous becomes adherent to a portion of the inner layer of the optic cup. As secondary vitreous forms, it tends to compress and isolate the primary vitreous. This occurs everywhere but in the region where the adhesion has taken place, and here the retina becomes tented and rolled up to make the definitive fold. Thus the fold may be found in any meridian and is not necessarily limited to the region of the fetal fissure. No cogent reason is given to explain the fact that the great majority of cases involve the inferotemporal quadrant.

## CASE REPORTS

*Case 1.* L. E. T., a 4-year-old white boy, was admitted to Babies Hospital in July, 1942, for evaluation of "strabismus and mental status." Birth had been nor-

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mal, without trauma. There was no history of convulsions. Development had been considerably retarded, and when the child failed to talk by the age of 2½ years, feeble-mindedness was suspected. A convergent squint had been present since the age of two months, and glasses, which the patient had refused to wear, were prescribed at the age of two years. There

were negative except for nystagmus and convergent strabismus. Neurologic examination revealed nothing of interest other than the obvious mental deficiency. Skull X-ray studies were negative. A summary of the psychometric examination was as follows: I.Q. of 56 according to the Stanford-Benet (form L) test and a mental age of 2 years and 4 months;

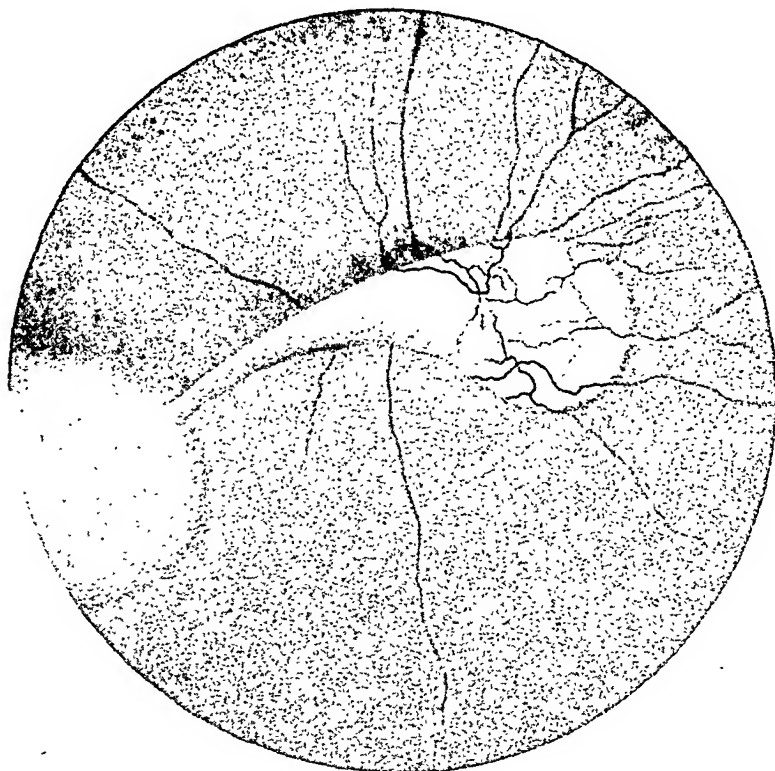


Fig. 1 (Guerry). Congenital fold of the retina, O.D.

were no other siblings. The family history was essentially negative except for the fact that the father had suffered from acute choroiditis in the right eye some eight years before.

At the time of admission the patient was found to be a mentally defective male who constantly demonstrated echolalia and echopraxia. His posture was poor, his body dirty, and from his open mouth saliva drooled continuously. The head measured 48.25 cm. and the sutures and fontanelles were closed.

The results of physical examination

the mental age according to the Merrill-Palmer Performance test was 1 year, 7 months. The electroencephalogram was normal, and all laboratory findings were within normal limits.

The patient was transferred to the Institute of Ophthalmology for further study. The visual acuity could not be determined because of the mental deficiency, but the patient appeared to see objects 1 cm. in diameter which were held 8 to 10 cm. from his eyes. A convergent squint of 30 degrees was present. The patient was unable to fixate with either eye, and

constant nystagmoid movements of searching character were present. The pupils were regular and equal and reacted promptly to light. When atropine was instilled the pupils dilated poorly because of the presence of congenital pupillary membranes of rather marked extent, but with the patient under ether a good view of the ocular fundi was obtained.

In the right eye, extending from the disc downward and temporally at the 8-o'clock position was a large grayish-white band with vessels entwined about its surface. This appeared to involve the macular region and extended peripheralward to the temporal aspect of the lens. The lens in that region showed peculiar fibrillary subcapsular cataractous changes. The disc itself was pale and elongated. The details of the remainder of the fundus were poorly seen, but the most distinct image was obtained with a -10D. sphere. A much clearer conception of the appearance of the fundus and lens is gathered from the artist's drawing (fig. 1).

When examination of the fundus of the left eye was carried out, an identical picture presented itself.

The fundi of both parents were then examined. No evidence of congenital folds with either definitive or of the "forme fruste" type was found. The only pathologic change noted was an area of old choroiditis up and temporally in the father's eye; and in the same eye two vitreous detachments were seen, one of annular shape in the region of the disc (so-called area of martegiani) and the other of irregular shape and situated at the temporal edge of the area of choroiditis.

The diagnosis of bilateral congenital folds of the retina was made.

*Case 2.* R. R., a 6½-month-old white female infant, a private patient of Dr.

Maynard Wheeler, was admitted to the Institute of Ophthalmology, in October, 1943, for examination of the ocular fundi under ether. At the time of birth a ptosis of the left lid was noted, but this disappeared after six weeks. The left eye was then found to turn inward, and the infant did not appear to see with either eye.

At the time of admission, physical examination revealed no abnormalities. The eyes of the infant failed to follow a light, and wandering nystagmus was present. The pupil of the left eye did not react to light, while that of the right eye reacted but sluggishly. The anterior chambers were somewhat shallow.

Under ether, and with the pupils moderately dilated with atropine, examination of the fundi was carried out. In the right eye a dense gray band was found to extend downward and temporally to the posterior surface of the lens, which appeared cataractous in that region. Blood vessels were seen over the surface of the fold. The remainder of the fundus appeared to be slightly pale and granular. The appearance was similar to that seen in case 1.

When the fundus of the left eye was examined the retina was found to be completely detached and markedly elevated. No holes were seen nor was there any evidence of a congenital fold. Transillumination was negative.

The diagnosis of congenital retinal fold in the right eye and congenital retinal detachment in the left eye was made.

#### DISCUSSION

The first case is primarily of interest in that the congenital folds were found in an individual with an obvious mental deficiency. The only other case in which the two conditions were associated was reported by Gartner.<sup>5</sup> In his case micro-

cephaly, microcrania, and subnormal mentality were present together with the congenital retinal folds.

The second case lends weight to Weve's conjecture that congenital retinal folds are closely related to congenital retinal detachments, and that the same mechanism is operative in each instance. He mentions the frequent association of these two conditions in members of the same family, but in no case did he find a fold in one eye associated with a detachment in the other.

In one case reported by Mann,<sup>2</sup> a partial congenital detachment below was as-

sociated with a congenital retinal fold in the same eye, but she, like Weve,<sup>3</sup> did not report the condition as occurring simultaneously in opposite eyes. This second case, therefore, appears to be the first such reported of a congenital retinal fold occurring in one eye and associated with a congenital detachment of the retina in the fellow eye.

#### SUMMARY

Two cases of congenital retinal folds are reported, one associated with feeble-mindedness and the other with a congenital detachment of the retina.

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# DIVERGENCE EXCESS CONSIDERED AS AN ANOMALY OF THE POSTURAL TONUS OF THE MUSCULAR APPARATUS\*

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For the past several years the author has been interested in divergence excess because of certain clinical features that do not seem to fit in with the prevailing theories regarding its pathogenesis. These discrepancies were brought dramatically to the fore in a patient who came under observation recently and who exhibited a combination of esophoria and exophoria, both of which were present on distance fixation.

The left eye, which diverges behind the screen, turns medially on shifting the screen to the right eye. When, however, the screen is moved from the right eye to the left, the right eye turns laterally, instead of medially as would be expected. When neither eye is screened the eyes are in perfect parallelism. Since both exophoria and esophoria are binocular functions, it is difficult to see how they can exist side by side in the same case.

Obviously, one must be dealing with two distinctly separate mechanisms, or mechanisms that are not mutually compensatory. If the esophoria is to represent a convergence excess, then the exophoria cannot be regarded as a divergence excess in an analogous sense, since in that case the two would neutralize each other and the resultant would be their algebraic sum.

Observation of the movements of each eye behind the screen helped to explain the apparent discrepancies noted in this case. When the screen was shifted from the left to the right eye, the latter at first made a diverging movement which in reality was a conjugate movement to the right along with the left eye; an instant

later it turned medially into a position of esophoria (see case report).

This case also illustrates the view long held by the author, that the tests for muscle balance which require the occlusion of one eye, or the suspension of fusion through other means, introduce artifacts into the clinical picture. One should, therefore, guard against relying too much on these tests for the diagnosis and optical correction of heterophorias. The longer the occlusion of one eye is maintained, the more apt is one to find heterophorias where none exist under physiologic conditions. Marlow, who originally advocated the prolonged occlusion test<sup>1</sup> (1924) for uncovering latent deviations, recently<sup>2</sup> (1938) admitted that he was in reality producing artifacts that have no relation to the normal physiology of the eyes. For instance, he found that after the occlusion test only 3.4 percent of the 700 patients tested had orthophoria, while 78 percent had exophoria.

The paradoxical behavior of the eyes in the aforementioned case has served as a stimulus for undertaking a critical inquiry into the various explanations offered for the physiologic processes involved in divergence excess.

## CRITIQUE OF PREVAILING THEORIES

In his epoch-making work on the classification of the motor anomalies of the eyes, Duane<sup>3</sup> introduced the term "divergence excess" to designate a certain type of exophoria as differentiated from convergence insufficiency. The diagnostic criteria set down by Duane served to circumscribe this condition as a clinical entity differing in certain fundamental respects from the other heterophorias.

\* Read before the New York Society for Clinical Ophthalmology, February, 7, 1944.

Duane defined divergence excess as follows: Exophoria for distance is usually marked (more than  $4^{\Delta}$ ). Conjugate lateral movements are normal. Prism abduction is greater than  $9^{\Delta}$ . Prism adduction is normal (greater than  $15^{\Delta}$ ). Occasionally, spontaneous crossed diplopia is observed. Exophoria for near is decidedly less than for distance. Near point of convergence is normal (less than 9 cm.). Symptoms are slight, except when convergence insufficiency is also present.

Duane's approach is invaluable from a didactic point of view, since it has brought order into a phase of ophthalmology which was, and still is, poorly understood. However, it is apparent that such a classification, based as it is on the results of several arbitrarily chosen tests, is not adequate for delimiting neuro-ophthalmologic entities. Unfortunately, the followers of Duane have tacitly accepted the term "divergence excess" in its literal meaning. This laxity in terminology has led to polemics between the American and European schools, the latter preëminently represented by Bielschowsky.

Haessler<sup>4</sup> sums up the present state of knowledge by admitting that the essential nature of divergence excess is not clearly understood. Referring to Duane's schematized concept he voices the admonition that "the geometric explanations and constructions must be accepted with great caution."

To illustrate the wide discrepancy that exists between the two schools one need but compare their respective estimates of the incidence of divergence excess. Berens, Hardy, and Stark<sup>5</sup> found this anomaly in 1 to 2 percent of an unselected group of patients, whereas Bielschowsky<sup>6</sup> stated that he has seen but one case in 50 years of practice. Dunnington<sup>7</sup> took an intermediary stand, claiming that some of the cases included by Berens *et al.* have too much exophoria at the near

point, and that therefore their estimate is too high. He required the exophoria for near not to exceed  $4^{\Delta}$ . Needless to say, he is still at variance with Bielschowsky, who reserved this diagnosis for a case in which unequivocal evidence is given of excessive innervation of the center for divergence.

Bielschowsky's case was that of a psychoneurotic young woman suffering from a high degree of myopia. Under atropine cycloplegia the myopia disappeared entirely, while at the same time the eyes changed from parallelism to a divergent strabismus. Obviously, the eyes had been maintained in a parallel position by virtue of a convergence spasm that was accompanied by a spasm of accommodation, resulting in a functional myopia. The fact that an excessive convergence innervation was required to overcome the divergent strabismus led Bielschowsky to the assumption that the primary affection was a divergence spasm. On the basis of this one case he formulated the general rule that the diagnosis of divergence excess is justified only if a convergence innervation is brought into play to overcome the divergence, as evidenced by the accommodation that invariably accompanies it. This method of reasoning is open to several objections. In the first place, it is not safe to generalize from a single case, especially since the presence of a psychoneurosis renders the case atypical. Secondly, the instillation of atropine affects neither the accommodation center nor the convergence center, but merely paralyzes the myoneural junctions of the ciliary muscle. Finally, if it is justified to draw an analogy from the mechanism of convergence, it may be assumed that the divergence center can be stimulated as well as inhibited through its intrinsic activity, without having to call upon the convergence center for help.

Bruce<sup>8</sup> may have sensed the flaws in Bielschowsky's argument when he dis-

missed it with the abrupt remark that "if a patient has excessive divergence he has divergence excess"; however, he failed to elucidate his own point of view. In fact, all evidence offered in support of the theory that Duane's divergence excess is a true stimulation of the divergence center is unconvincing. The function of divergence is rudimentary in man and is not subject to voluntary control. Dunnington regards it as the "power" used only to maintain parallelism. It is difficult to reconcile these facts with the high degrees of divergent strabismus observed in these cases, and the ease with which the deviation can be overcome by the mere shift to near fixation or even by the simple expedient of focusing one's attention on the distant object. Moreover, the absence of diplopia (except for a fleeting moment in some cases) is indicative of a congenital anomaly rather than a pathologic disturbance of the central nervous system. There is no evidence to support the view that active convergence plays any part in the change from divergence to parallelism; for during this change the size of the pupils remains the same, the visual acuity for distance is not impaired, and the interposition of any concave lens reduces vision rather than improves it.

To summarize what has been said thus far, divergence excess as defined by Duane represents a distinct clinical entity. Its incidence is sufficiently frequent to render it deserving of careful consideration by the ophthalmologist. Its pathogenesis has not been adequately elucidated thus far. It appears to have been reasonably well established that the anomaly is not caused by an excessive innervation of the divergence center.

#### THE CONCEPT OF THE "POSITION OF REST"

Bielschowsky expressed the view that divergence excess is due to an anomalous

position of rest. In determining this position, he assigned prime importance to the anatomic arrangement of fasciae and ligaments. Yet he spoke of a "relative" position of rest, which implies a dependence upon other than anatomic factors. Since this term, too, is used rather loosely, it would seem proper to review some of the neurophysiologic principles underlying the concept of the position of rest.

The position that the eyes assume when at rest depends to a large extent on which portion of the central nervous system happens to play the dominant role at the time. Thus, in sleep, when the cerebral cortex is inhibited, the eyes assume the position of divergence and upward rotation. In the waking state, too, partial decerebration is a common experience, as in daydreaming, or as in the startle phenomenon (Rosett<sup>9</sup>). As a matter of fact, there is a characteristic "position of rest" for each state of activity of the central nervous system. The change from the sleeping to the waking state brings the fixation reflex into the picture, while a still higher level of cortical control is associated with the functions of convergence and fusion. Obviously any of these positions represents a definite postural-tonus adjustment of the muscular apparatus of the eyes, and it is wrong to consider any one of these as the position of rest to the exclusion of the others. Only the cadaveric position can be regarded as dependent exclusively on anatomic factors.

The position of rest generally referred to by ophthalmologists and the one most easily approximated under the conditions of clinical tests is the fusion-free position. It represents the posture prevailing when fixation alone is exercised. Fixation is maintained reflexly as long as visual stimuli are transmitted to the brain, but its reflex arc probably passes subcortical-

ly. It is only when a change of fixation is involved that the cortical function comes into play.

The attention-mechanism seems to play the determining role in placing fixation under cortical control. Many patients with divergence excess, for example, are able to inhibit the deviation on fixating an object 5 to 6 feet away, and in some cases even at 20 feet, provided they concentrate their attention on the fixation-object. For this reason, a test chart or a similar attention-provoking object offers a more optimal stimulus than the customary muscle light.

The position associated with reflex fixation thus represents not a position of rest, but rather that state of postural tonus which is under the least amount of cortical control, and yet lends itself to quantitative clinical comparison.

The complicated nature of the fixation process has been aptly demonstrated by Gordon Holmes<sup>10</sup> in a study of the eye movements in cases of pseudobulbar palsy, in which the cortical control of the cranial nerves is absent. These patients cannot shift fixation from one object to another voluntarily; yet their eyes may be made to turn in any direction by either moving the fixation object slowly or by rotating the head passively while fixation is being maintained. It seems as though the eyes are held in a state of obligatory reflex fixation. An inhibitory stimulus from the cortex is required to suspend the prevailing fixation long enough to allow it to shift in response to a visual stimulus impinging on a peripheral portion of the retina.

The tonus-regulating role that is played by the fixation mechanism and by the higher cortical centers has not received sufficient emphasis in ophthalmologic literature, attention being focused principally on the voluntary phase of innervation. The latter constitutes merely the

kinetic component, whereas the former is the essential prerequisite for the maintenance of effortless, distinct, and uninterrupted vision in spite of the movements which the head continually makes relative to the fixation object.

It may be assumed that the extra-ocular muscles maintain a postural tonus that differs from that of the other skeletal muscles only in the nature of the afferent portion of the reflex arc. For it has been shown that the proprioceptive impulses from the ocular muscles are inadequate to account for the delicate balance of tonus that is maintained in these muscles (Irvine<sup>11</sup>). They are supplemented by visual impulses originating in an area of the retina immediately surrounding the fovea. Thus the imaginary line that connects the fovea with the point of fixation acts like a spring holding the eye in check and inhibiting any adventitious movements in response to stimuli from other sources. This unique mechanism for the control of tonus is probably related to the anatomic peculiarity of the ocular muscles, which possess a second, well-defined system of nerve fibers, in addition to the usual motor supply. These delicate fibers have grapelike nerve endings, such as are found in the muscle of cold-blooded reptiles and amphibians, but not in any other skeletal muscles of mammals (Duke-Elder<sup>12</sup>). Further evidence to demonstrate the archaic nature of the mechanism which the ocular muscles possess is seen in their reactions to choline and nicotine. They respond to these drugs in a manner similar to the voluntary muscles of animals below mammalia, or to the voluntary muscles of mammals before they have received their nerve supply or after they have been deprived of it (Duke-Elder<sup>12</sup>). It would seem that the ocular muscles have retained a certain characteristic which has been lost to other skeletal muscles and

which is analogous to that found in involuntary muscles. Upon it depends their ability to maintain a state of plastic tonus for an indefinite time without undue expenditure of energy.

It is evident from these remarks that the mechanism which regulates the postural tonus of the ocular muscles is distinct from the voluntary innervation and that it is of prime importance in maintaining fixation as well as spatial orientation. It is not definitely known what centers control the tonus, but the latter would seem to have at least two sets of connections: through the optic nerve with the occipital cortex and through the medial longitudinal bundle with the vestibular centers.

#### PATHOGENESIS OF DIVERGENCE EXCESS

The concept of postural tonus of the ocular muscles and its central control opens up new lines of thought. Its implications in connection with vertical deviations will be dealt with in a subsequent communication. The most striking demonstration of its applicability is seen in the case of divergence excess, which may thus be considered as an anomaly of the tonus-equilibrium of the ocular muscles. That this anomaly is in the nature of an atavistic tendency may be deduced from the fact that both in ontogenetic and phylogenetic development the visual axes tend to migrate from a lateral to a frontal position. In evolutionary history this trend is associated with the acquisition and perfection of binocular vision. Thus it is not surprising to find an occasional individual in whom the two levels of central control exist side by side; the one determining the lateral position of the eyes, the other the parallel position. Dominance of the more primitive level of central control results in laterally placed eyes. This may be the case when the fixation reflex alone is acting, which, as has been seen,

does not have to pass through the cerebral cortex. The higher level of tonus control, which is associated with a parallel position of the eyes, becomes effective when visual activity brings the cerebral cortex into play. This is the case as soon as convergence, fusion, or even attention is exercised.

Thus it is that, in near vision, when convergence, fusion, and attention are at their maximum, the more primitive tonus pattern is inhibited and the eyes exhibit a normal behavior. If an exophoria of appreciable amount is noted on near fixation, it is generally spoken of as convergence insufficiency. It should be looked upon as an independent anatomic abnormality that may be superimposed upon the divergence excess.

Duane speaks of divergence excess that is secondary to convergence insufficiency and vice versa. Haessler<sup>4</sup> rightly objects to this by stating that he has "found no publication of the record of an individual patient in whom such a reciprocal change in the magnitude of convergence and divergence has been measured from time to time."

Occasionally, other heterophorias may be adventitiously associated, as in the illustrative case reported here, in which esophoria was presented in combination with divergence excess.

#### CLINICAL FEATURES OF DIVERGENCE EXCESS

Essentially, the writer agrees with the diagnostic criteria as set down by Duane. Hence, only those clinical features need be dealt with which bear either on the differential diagnosis or on the pathogenesis.

The most striking feature in divergence excess is the fact that in spite of the high degree of exophoria present, subjective symptoms of asthenopia are either minimal or entirely lacking.

The abnormality has its onset early in childhood, usually between the second and third years of life, and the parents are often the first to observe the deviation. The typical story is that the child's eyes are straight, as a rule, but that on occasions, as when the child is tired or when he is gazing absently into space, one eye is seen to diverge. As time goes on, the deviation may occur more frequently, but it usually does not change much in character, provided that the vision is normal in both eyes and that a good fusion faculty is present. If any other heterophoria is superimposed, it will, of course, affect the clinical findings, rendering the case atypical.

On examination, it is often noted that divergent strabismus appears when the patient fixates a muscle light at 20 feet, whereas the eyes can be made to maintain parallelism by reading test letters at the same distance. This difference in behavior is due to the inhibiting effect of the attention-mechanism on the deviation. While the attention factor alone exerts an appreciable influence in some cases only, the change to near fixation is always effective in inhibiting the exophoria. The inhibiting action begins as soon as an appreciable degree of convergence comes into play, usually at about one meter, and becomes more definitive as the fixation object is brought closer.

The visual acuity of both eyes is usually within normal limits; however, the eye that habitually deviates, being the non-dominant eye, may have a slightly lower acuity than the other.

In the majority of cases no evidence exists of a neuropathic constitution.

The near points of convergence and accommodation are normal.

Prism adduction is normal; namely, 20<sup>A</sup> or more.

Prism abduction is, of course, increased by the amount of the angle of squint.

However, in those cases in which it is possible to maintain parallelism for distance through the exercise of attention, it may be demonstrated that prism abduction is only perhaps 4 or 5<sup>A</sup>. When more prism, base in, is used, fusion is relinquished and there may be fleeting diplopia during the time that the eyes are shifting into the divergent position.

In most cases, the deviation is not progressive. Even when convergence insufficiency is present, it is rare to find a permanent divergent strabismus developing, unless vision is lost or greatly reduced in one eye.

Therapy has proved unsatisfactory. Except for the correction of refractive errors, nothing can be done toward reducing the deviation. Any successful results obtained with prism exercises or surgery by some ophthalmologists must be ascribed to a modifying effect on a coexistent anatomic exophoria or convergence insufficiency.

#### CASE REPORT

A soldier, aged 21 years, was first seen at the Eye Clinic, General Dispensary, U. S. Army, Washington, D.C., on June 25, 1943. He complained that his left eye would tend to wander out on looking into the distance, but not on looking at near objects. This condition had existed since early childhood.

Vision: right eye 20/20; left eye 20/25.

Media, fundi, and pupils were normal.

Refraction under cycloplegia was carried out, with the use of four instillations of 2 percent homatropine hydrobromide at 15-minute intervals. The following correction was accepted: R.E. +0.25D. cyl. ax. 90°; L.E. +2.50D. sph.

At the post cycloplegic test, June 29, 1943, the patient accepted the following correction, which was prescribed: R.E. +0.25D. cyl. ax. 90°; L.E. +1.75D. sph.

*Muscle examination.* The left eye

diverged 20 degrees on being screened, to return to the primary position when the screen was removed. The right eye, on the other hand, did not diverge, but rather converged behind the screen, for it could be seen to diverge when the screen was removed. The esophoria displayed by the right eye measured  $10^{\Delta}$ . When neither eye was covered, the eyes were parallel and binocular single vision was maintained. However, the patient was able to diverge his left eye voluntarily. When binocular fixation was maintained, which was facilitated by the exercise of attention, esophoria could be elicited in either eye by means of the screen test. The esophoria diminished as the fixation-object was brought nearer until, at 30 cm., the Maddox rod test showed orthophoria.

With the correction found on the postcycloplegic test the esophoria was reduced to  $5^{\Delta}$ , whereas the amount of divergent strabismus when the left eye was covered remained unchanged.

When the behavior of the eyes was observed behind the screen, it was noted that, as the screen was shifted from the left eye to the right, the latter at first

made a rapid conjugate movement to the right, but as soon as the left eye assumed fixation the right eye converged until it reached the position of esophoria, which it maintained while being screened.

### SUMMARY

1. A case of divergence excess combined with an esophoria is reported.

2. The prevailing theories regarding the nature of divergence excess are discussed.

3. It is shown that divergence excess is due neither to excessive stimulation of the divergence center nor to an anomalous position of rest dependent on anatomic factors.

4. It is proposed to regard divergence excess as an anomaly of the postural tonus of the extrinsic muscular apparatus in an atavistic sense.

5. According to this view, the eyes are capable of maintaining one of two alternative postures: a more primitive divergent one, or a more recently acquired parallel one, depending on the degree of cortical control which is being exercised.

*General Dispensary, U. S. Army.*

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# NOTES, CASES, INSTRUMENTS

## NEVUS FLAMMEUS ASSOCIATED WITH CONJUNCTIVAL TEL- ANGIECTASIA AND POS- SIBLE EARLY CHOROI- DAL TUMOR

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Statistical analysis of one year's work at one of the eye clinics of a Station Hospital reveals the presence of many conditions which in large series would have great value. Some of these conditions are unknown to the patient and have existed unrecognized since infancy. For the most part these conditions are congenital or developmental, and, as such, may have related anomalies in other special sense organs or in specialized fields. Certain anomalies found in the eye which have interesting correlations in other specialties are frequently encountered.

The attention of physicians is called to the frequent association of an easily detected condition that may be considered a sign pointing to more serious internal manifestations; namely, the so-called nevus flammeus of the face and other related nevi. These are readily visible, and if the conditions associated with them are borne in mind a much earlier diagnosis would be made and possible therapeutic aid rendered.

The patient, aged 36 years, was seen at the eye clinic on January 15, 1943. He had no specific ocular complaint and came to the eye clinic by reference from the orthopedic clinic with whose members the interesting interrelationship that exists between nevus flammeus and ocular vascular disease had been discussed. The patient stated that he had been born with this nevus upon his face. It had shown little or no change as long as he could remem-

ber. The patient had attached no significance to the vascular tumor; his parents had never investigated its nature nor sought treatment for the disfigurement. In 1932, a course in electro-desiccation was undertaken in order to remove the tumor. After several unsuccessful treatments, this therapy was discontinued. The patient had never had convulsions, loss of consciousness, muscular twitchings, paresthesias, sensory loss, nor any evidence of mental aberration. There was no family history whatever of convulsions or mental disturbance. One cousin (second) has a facial nevus that resembled the patient's nevus in many respects. One aunt, about whom the patient knew very little was feeble minded. There was no knowledge of familial intermarriage. No family history of visual disturbance or congenital defects could be obtained.

The nevus flammeus involved the left side and encroached upon the outer fifth of the lower half of the left upper lid; the entire lower lid, extending down as far as the ala nasi and onto the posterior half of the nose; the left temporal region just anterior to the hair line; the upper third of the left ear; the entire posterior aspect of the left ear; an area in the scalp that included the entire hairline, starting in the left temporal region and extending over parietal and occipital area to the middle of the scalp; an area in the left lateral neck region; and an area just above the sternum.

Besides these cutaneous regions of vascular involvement there was telangiectasia of the left palate in the region of the second and third molars and increased vascularity of the left posterior tonsillar wall. Study of the eyes disclosed the following interesting features: (1) The



Figs. 1, 2, 3 (Rosen). External involvement in a case of nevus flammeus.

lower lid showed a conjunctival structure that was extremely red, dilated, and made up of many vessels, seemingly abnormal. (2) The bulbar conjunctiva had an increased formation of tortuous and racemose vessels. Many were redundant and irregular in caliber and showed an interlacing and entwining seen in telangiectasia (figs. 1, 2, 3).

The conjunctival vascular disturbance was present only on the temporal side. There was no disturbance of the iris vessels, no abnormal vascular formation nor prominence.

The most interesting feature of the ocular examination was the presence of a small white plaque just above the disc, about one fourth the disc in size and hemispheric in shape (fig. 4). Its color was whitish or yellowish white. There appeared to be no striations, radiations, nor medullations from this area. It was not elevated. The veins showed a slight element of engorgement, and in some areas where arteries crossed veins there was constriction. If this structure was medullation of nerve fibers just off the disc, it may have been related to the nevus flammeus, since myelinated nerve fibers in the retina have been described as early and occasionally the only manifestation of von Recklinghausen's disease. This same disease has occasionally been described as being localized in the tri-

geminal nerve following its course of distribution just as the nevus flammeus does.

X-ray studies of the skull for calcified areas in the occipital region were reported as negative. Tonometric readings of the eye were 22 mm. Hg (Schiötz) in each eye. Visual-field studies for form and color were normal, but blind spots showed somewhat of a vertical enlargement upon the left side. Check upon the mucous membrane of the nose showed no further vascular involvement and consultations with neurologic, rhinologic, dermatologic, allergic, and roentgenologic departments disclosed nothing of further note in this case.

There has been no history of recurrent nosebleeds nor hemorrhage from the mouth. Tonsillitis has occurred occasionally; the tonsils had not been removed.

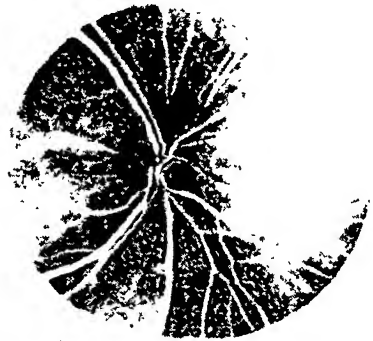


Fig. 4 (Rosen). Nerve head with small white mass above disc.

Nevus of the face apparently involves the first two branches of the trigeminal nerve and is such a characteristic finding that the condition has been called angiomatosis encephalo-trigeminata, and may, accordingly, involve all structures supplied by this nerve. It has been shown that not infrequently nevus flammeus is associated with microphthalmos, hemangiomas retinae, and hemangioma of the choroid. It has also been shown that in 95 percent of all cases of hemangioma of the choroid the hemangioma takes its origin from the region between the disc and the macula. No anatomic explanation has ever been offered to show why this rare tumor is so common at this site and why its progress is so slow and insidious. In most of the cases of hemangioma of the choroid a bone plate forms over the tumor area and locks the vascular mass within a bony shell. This may be a late complication of hemangioma of the choroid, but since there are only four cases in which this tumor was visualized and described before pathologic study, it is quite difficult to state just what the appearance of this type of tumor might be in the very early stages.

The need to be on the lookout for such a tumor in patients with nevus flammeus has been pointed out by Salus, Quackenboss and Verhoeff, Ludwig, Brons, and others. The presence of a small white plaque in the region in which 95 percent of hemangiomas develop, therefore, may be the very first appearance of this slow-growing tumor.

Nevus flammeus of the face is often associated with meningeal involvement of the area supplied by the trigeminal nerve. Such a meningeal hemangioma is subject to ready bleeding—it is only logical that every case of so-called epilepsy associated with facial nevus should be investigated roentgenologically. As Cushing has pointed out, early surgery before menin-

gial adhesions have occurred, will remove the etiologic factor.

Nevus flammeus occurring on the same side as an enlarged eye or a microphthalmic eye or a congenitally blind eye, should always cause one to look for a hemangioma within that eye. The eye may be blind owing to a secondary glaucoma that may follow a hemangioma of the choroid. The glaucoma may be of the congenital variety or there may be vascular anomalies in other areas of the uveal tract. Mental deficiency and hemiplegias associated with nevi are actually more advanced phases of the same syndrome. An embryonic explanation has been offered to show the relationship between nevi of the face and meningeal angiomata. It has also been pointed out that the meningeal angiomata have a decided tendency toward calcification and bone formation so that X-ray localization may be undertaken; certainly electro-encephalographic data should be acquired in all cases of this sort.

It is also interesting to note that Cobb has reported a case of hemangioma in the spinal meninges with nevus involvement of the corresponding cutaneous area.

The object of this report, therefore, is to point out the clinical importance of nevi and telangiectasia, so that cases may be referred to the proper specialists by whom Sturge-Weber disease, von Hippel Lindau's syndrome, and hemangiomas may be uncovered. In 1906, Cushing treated a case of nevus flammeus of the face of a child suffering from recurrent epileptic seizures. The suggestion given by the child's father, that the convulsions might be related to a possible hemangioma, did not go unheeded, for it was that very suggestion that caused Cushing to continue further study of this field of vascular tumors until he had shown this striking interrelationship.

*Station Hospital.*

## GLAUCOMA—SCLERECTOMY, EXTERNAL AND SUPRA- CHOROIDAL DRAINAGE

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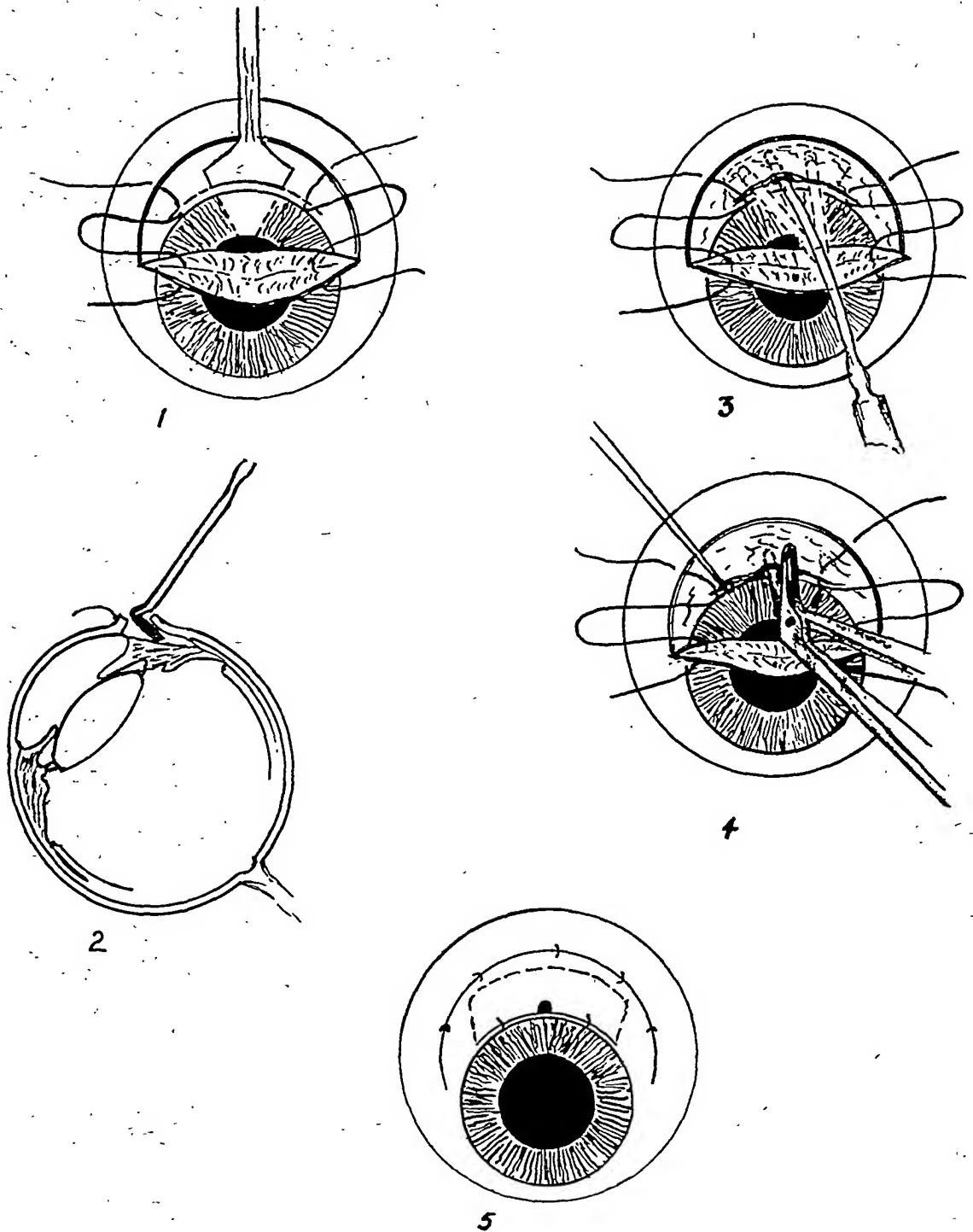
No one surgical technique can meet all requirements of glaucoma. For acute glaucoma we still rely on basal iridectomy. For the wide-angle noninflammatory types, seen early, we have favored the Elliot trephine. For protracted glaucoma not yielding to those mentioned we have preferred our Seton drainage technique.<sup>1</sup> A sclerectomy with the aid of the punch has also frequently been used. In addition we have reported two cases operated on by the Troncoso method.<sup>2</sup> Since 1920, in selected cases of cataract surgery in which glaucoma was coexistent, the senior author has used a modified punch sclerectomy.<sup>3</sup> The technique is essentially the same as here described except that for cataract we employ a larger corneal section. The results have impressed us very favorably, especially when glaucoma and cataract were coexistent. Frequently tension is considerably reduced following intracapsular extraction alone, but more especially if combined with this method. Consequently, when miotics fail to control the tension we have more and more favored early intracapsular extraction plus the sclerectomy, rather than preliminary iridectomy and extracapsular extraction.<sup>4</sup> Surgery, of a cyclodialysis type, for the purpose of obtaining suprachoroidal drainage, if it could be maintained, seems nearest to the ideal. In the narrow-angle type of glaucoma, with a history of clinical evidence of uveal disease, we have been highly impressed with the results of this modified Lagrange technique performed to obtain both external filtration and suprachoroidal drainage. In 14 cases

of the narrow-angle type in which the lens was clear, or nearly clear, we have used the technique described herein. These were cases with advanced surgical indications.\*

A broad conjunctival flap is dissected down to the limbus under Tenon's capsule if possible. Two silk sutures are placed first through the conjunctiva, then anchored in the sclera very close to the limbus and laid to one side. A keratome incision is made at the limbus (fig. 1). This incision is enlarged by Wilder scissors along the limbus from the 10:30- to the 1:30-o'clock position. If the lens is to be extracted, the corneal incision is carried on with the scissors from 3 to 9 o'clock. The silk suture is then passed from underneath through the conjunctival flap exactly at the junction of the cornea and conjunctiva. A loop is made on each side and laid aside. Next the cyclodialysis is performed, sweeping the angled Green iris repositor from 10:30 to 1:30 o'clock (fig. 2).

In performing a cyclodialysis, it is well to remember the histology of the ciliary body. In the choroid, the delicate lamellae of the epichoroid permit a potential space to exist, the perichoroidal space. Anteriorly, the lamellae disappear into the ciliary muscle so that there is no perichoroidal space in the region of the ciliary body. The width of the ciliary body, according to Salzmann,<sup>5</sup> is 4.6 mm. to 5.2 mm. nasally, and 5.6 mm. to 6.3 mm. temporally. However, one should allow about 8 mm. from the limbus to be certain of extending beyond the ora serrata. It is probably not enough, then, merely to detach the ciliary body from the scleral spur. Anatomy of the iris shows it arises not from scleral spur or limbus but from the anterior end of the ciliary body, so a

\* Four additional patients have been satisfactorily operated on since this paper was submitted for publication.



Figs. 1 to 4 (Wolfe, Wolfe, and Georgariou). Modified Lagrange sclerectomy with cyclodialysis.

Fig. 1. A broad conjunctival flap dissected well down to the limbus under Tenon's capsule and episclera if possible. Two scleral sutures are inserted in sclera near limbus at the 1- and 11-o'clock positions. A keratome incision is made at the limbus and completed with scissors from 10:30 to 1:30 o'clock. For cataract the scissors section is to 3 and 9 o'clock.

Fig. 2. The curved end of the Green iris repositor is inserted under the scleral margin of the section and the ciliary body is separated from its insertion at the scleral spur. For glaucoma the corneal section extends only from about 10:30 to 1:30 o'clock, and not so large as illustrated in figures 1, 2, 4, and 5.

Fig. 3. The straight end of the marked Green iris repositor is then inserted and the ciliary body

true cyclodialysis would not touch the iris.

To be certain of contacting the perichoroidal space, the dissection must be carried back behind the ora serrata. Only then may one be certain of having performed a true cyclodialysis. However, following the use of the angled Green iris repositor (fig. 3) the straight end is employed to complete the cyclodialysis (fig. 4). The straight tip has lines every 2 mm. from the tip to help in estimating depth. If the lens is to be removed it is done at this time intracapsularly. Then the scleral lip of the wound is picked up with a hook and a sclerectomy is performed with a Holth punch, to accomplish a modified Lagrange operation. Dr. Ramón Castroviejo also uses such a punch technique.<sup>6</sup> Any scleral tags are cut smooth. If the iris bulges it is merely snipped without the forceps. (A complete iridectomy is performed for the

cataract extraction.) The two looped sutures are then drawn up and tied. Four to six additional conjunctival sutures are used to obtain better closure. An under-and-over continuous watertight suture can be utilized for this last step. Post-operative hyperemia has been moderate. Dressings on the second day demonstrate external filtration under the flap with partially restored anterior chambers and abated tension. Only one patient had prolonged hypotension.

### SUMMARY

This is a preliminary report of a method of modified Lagrange sclerectomy combined with cyclodialysis to obtain suprachoroidal drainage plus external filtration. The technique is essentially the same with or without cataract extraction. In 18 cases the method has given satisfactory results, and its wider use seems to be indicated in selected cases.

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is dissected free of the sclera to a point just beyond the ora serrata, thus assuring contact with the perichoroidal space. Repositor has graduated scale every 2 mm. to gauge depth. An iridotomy or iridectomy is performed as indicated.

Fig. 4. Either preceding or at this stage a silk scleral suture is passed through the corneal flap at the exact junction of cornea and conjunctiva, is looped and laid aside. By holding the scleral lip with a hook, a modified Lagrange sclerectomy is performed with Holth punch. (If cataract is removed, the sclerectomy is the last step before closing flap.)

Fig. 5. Schematic. The two scleral limbal sutures are drawn up and tied. Where a broad conjunctival flap is used a double-needled suture is brought out through the conjunctiva at the limbus instead, as illustrated in figures 3 and 4. Additional conjunctival or a continuous watertight suture is used. Black dot indicates site of sclerectomy giving external drainage. Dotted line indicates area of cyclodialysis.

# THE APPLICATION OF GUIST'S LOCALIZING INSTRUMENT IN THE EXTRACTION OF INTRA- OCULAR FOREIGN BODIES BY THE POSTERIOR ROUTE

AN INSTRUMENT FOR MORE ACCURATE  
PLACING OF THE SCLERAL INCISION

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The aim of the operator in performing a magnet extraction of an intraocular foreign body should be, as in all other surgical procedures, to accomplish the desired result with the least possible trauma. In some cases this may be done best by using the anterior route, in others the posterior. By either method, much damage may result from dragging a rough particle along the inner surface of the retina. If the operator were able always to make his scleral incision directly over the foreign body, such trauma would be avoided.

If a patient with an intraocular foreign body has had an X-ray localization made by the Comberg contact-glass method, the roentgenologist's report will localize the foreign body according to the meridian in which it lies, and according to its distance

behind the limbic plane.

There is a device that is very helpful in properly placing the incision for the removal of such a foreign body by the posterior route. Introduced by Guist, in 1930, for the purpose of indicating on the scleral surface, retinal tears in cases of retinal detachment, it consists of a metal ring, the size of the corneal limbus, divided by notches into 36 spaces, one for each 10 degrees of the circle. A metal strip arches from the 0- to 180-degree position on the ring, and to the apex of this arc is attached, by a thumb screw, an arm or pointer which can be set in the meridian indicated by the X-ray report (fig. 1). The operator then measures off on the pointer the indicated distance from the limbic plane, and, after exposing the sclera, places the indicating device in position and marks on the sclera the proper site for his incision. Several pointers are necessary, and are made of soft metal that can be cut to the indicated length.

Although the use of this instrument does not, perhaps, make the operation so accurate as one might wish, it is a distinct and worthwhile help and has been used with gratifying results in four operations.  
*671 Broad Street.*

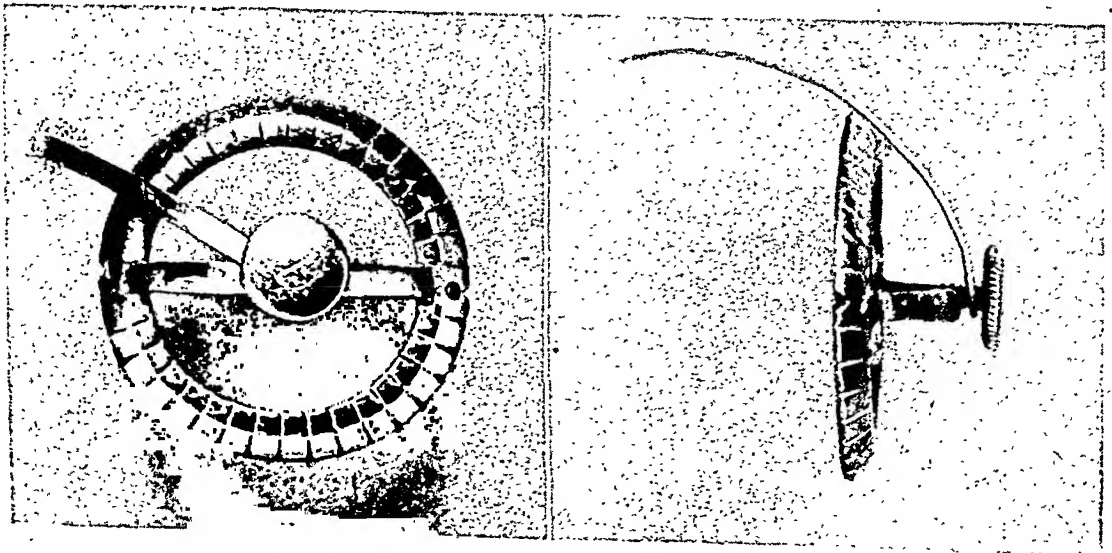


Fig. 1 (Sherman). The Guist localizing instrument.



# SOCIETY PROCEEDINGS

EDITED BY DR. DONALD J. LYLE

## CHICAGO OPHTHALMOLOGICAL SOCIETY

April 19, 1943

DR. LOUIS G. HOFFMAN, *president*

### CLINICAL PROGRAM

(Presented by the staff of the Illinois Eye and Ear Infirmary)

#### ENCYSTED INTRAOCULAR FOREIGN BODY

DR. WILLIAM BAUMGARTNER presented J. D., a 12-year-old boy, who stated that vision in the right eye had been poor for four years following injury when a piece of glass entered the eye. Vision, R.E., 5/200; L.E., 20/20.

A linear perforating scar was seen in the cornea at the 3-o'clock position, with a hole in the iris opposite the scar. The pupil dilated irregularly due to posterior synechiae between the pupillary border of the iris and the anterior lens capsule. The visible portion of the capsule was intact. Dense localized cortical lens opacities were seen on slitlamp examination in an area roughly corresponding to the iris hole. The vitreous was clear. At the posterior pole of the eye there was a white mass about the size of the disc; this projected forward into the vitreous cavity, and appeared to be made up of white opaque substance with a thin covering of glial tissue. A stellate retinitis was also seen.

On retinoscopy with cycloplegic the vision could not be improved beyond 20/100. There was a large central scotoma. The peripheral fields were normal. The tension was 18 mm. No siderosis nor chalcosis was seen. On X-ray examination a small foreign body of metallic density was seen slightly above and lateral to the disc.

#### PULSATING EXOPHTHALMOS

DR. PAUL STERNBERG said that Mrs. J. C., aged 58 years, gave a history of a fall in November, 1942, following which she was semiconscious for five days. Upon regaining consciousness, she was aware of a pulsating noise in the ears, diplopia, and drooping of the right upper lid. Protrusion of the eyeball was noted several weeks later.

Vision with correction was 20/30 in each eye. Tension was 21 mm. (Schiötz) in each eye. The exophthalmometer reading was 27 mm. and 20 mm. in right and left eye, respectively. Ptosis of the right eyelid was present, and both eyelids were somewhat swollen. The conjunctiva was chemotic and injected; the anterior ciliary vessels were dilated. Pulsation was felt upon mild pressure of the hand over the closed eyelids. A bruit was heard with the stethoscope over the entire eyeball. There was limitation of movement of the eyeball in all directions. The pupil was dilated and fixed. The retinal veins were dilated and the arteries showed grade 2 arteriolar sclerosis (Wagener); there were no retinal hemorrhages; the disc was not edematous.

Perimetry findings showed the right field to be enlarged compared to the left eye, due to elimination of restriction of the orbital rim. The external and internal ophthalmoplegia was due to a lesion of the 3d, 4th, and 6th nerves within the cavernous sinus. The blood pressure was 180/100.

#### CORNEAL FISTULA

DR. ALLAN M. SAKLER presented L. H., a white woman, aged 60 years, who said that two months prior to admission, on turning on a fan, she had

experienced a sudden piercing pain in the right eye. There was a history of inflammation of the right eye during childhood, with a resultant corneal scar.

Vision, R.E., light perception and projection; L.E., 20/100. On examination, an adherent leukoma was found situated centrally in the right eye, in the center of which was a 1-mm. fistulous opening which drained intermittently. The anterior chamber was absent centrally and shallow elsewhere. On gonioscopy, extensive peripheral anterior synechiae were seen, producing blocking of the angle. The tension was soft.

Occasionally the patient experiences intermittent pain before the fistula begins to drain about one drop of aqueous. Observation during these periods reveals a bleb just anterior to the fistula, which stains with fluorescein, revealing a small ulcer. It is believed that the fistula is due to a perforating injury adjacent to an old leukoma.

#### OPTICO-CILIARY VEIN OF LEFT DISC

DR. DAN M. GORDON presented D. J., a boy, aged 13 years, whose vision was 20/20 in each eye. Both fundi were essentially negative except that the disc of the left eye presented a vascular anomaly: A large vein was present on the disc at the 4-o'clock position which plunged into the physiologic cup. This was a retinal vein which had taken on the anomalous function of draining the choroid, and was one of the rarer vascular anomalies of the fundus.

#### TRAUMATIC HOLE IN THE MACULA

DR. ELIZABETH OLMSTED said that W. C., a white boy, aged 10 years, complained of poor vision in the right eye, noticed accidentally five months ago. He had been struck in the eye with a tennis ball four years ago.

Vision, R.E., 20/200; L.E., 20/20. A circumscribed lesion was seen of 0.5 disc

diameter in the right macula, with a small tag of retina floating in front of it. From this finding it was concluded that the hole in the macula resulted from the formation of a cyst which subsequently ruptured. There was no evidence of degeneration in the retina nor of toxic effects from anterior uveitis.

#### TOXOPLASMOSIS (abstract)

DR. ARLINGTON C. KRAUSE and (by invitation) DR. WILLIAM ROSENBERG. The etiologic, clinical, pathologic, laboratory, and therapeutic features of human toxoplasmosis were briefly reviewed, emphasizing that the disease is probably not so rare as we might tend to believe. Attention was focused on the ocular components of this entity.

Seven previously unreported cases were presented. Four of these were infantile or congenital, one was of the childhood type and two were in the adults. In five the diagnosis of toxoplasmosis was positively proved by laboratory methods. In the two remaining cases the serologic proof could not be obtained because Dr. Sabin was no longer doing that work; other facilities were not readily available. In each case the ophthalmoscopic signs were outstanding.

Toxoplasmosis should be considered or at least ruled out as a possible exciting factor in obscure cases of uveitis where exhaustive search and study do not reveal any specific etiology. Especially to be considered are young adults with large macular chorioretinitic lesions and no evidence of a vascular basis for the picture.

At the present writing several other highly suspicious but as yet unproved cases are being followed. (This is a preliminary report.)

*Discussion.* Dr. Douglas Buchanan: Toxoplasmosis has been known for some years to laboratory workers, and known as an endemic infection among laboratory

animals. According to Sabin it might occur in humans. Wolff, in New York, found peculiar areas in the brains of patients dead of encephalitis, and Sabin suggested that these were due to toxoplasmosis. Sabin's test is rather cumbersome, requires laboratory animals, and takes several days to complete. If the test is positive he believes that the disease is present. His work on complement-fixation tests was halted by his going into the armed service.

If the disease is an intrauterine infection it might explain some cases of infants born with misshapen heads, spasticity, and the like. Poor vision, mental retardation, or convulsions may be due to the child having been infected before he was born. Almost invariably the mothers of such children, although they have positive blood tests, have no symptoms. In one case the mother had three children, and it would be reasonable to assume that all suffered, although only one case was seen. In another case one child had the disease and a subsequent child was normal. It is apparent that mothers can harbor this condition just as they can carry syphilis; some children will have toxoplasmosis and some will escape.

The patients in all of Sabin's cases had chorioretinitis or calcification of the brain. In none of the cases here reported were there intracranial calcifications. He said that without these findings no patient gave positive tests.

It would be interesting to know why the chorioretinitis is more often than not situated in the macular region, with white disc or white spots in the macula, giving an appearance almost as characteristic of this disease as the cherry-red spot is in Tay-Sachs's disease.

Dr. Sanford Gifford was interested in knowing where the tests could be made, inasmuch as Dr. Sabin is now in service. He had a case in which the diagnosis is suspected.

Dr. Arlington C. Krause said that the test is not available here at this time, but might be at a later date. It requires laboratory animals and much equipment.

He had no theory as to why the chorioretinitis should appear in the macular region particularly.

Dr. William Rosenberg (closing) mentioned that Dr. Buchanan hoped to have facilities available within a short time for testing cases at the University of Chicago, but whether other cases could be checked it was not possible to say at this time.

Robert Von der Heydt.

## SAINT LOUIS OPHTHALMIC SOCIETY

October 22, 1943

DR. CARL BEISBARTH, *president*

### SCISSORS SECTION IN CATARACT SURGERY

DR. H. R. HILDRETH reported the analysis of a series of 100 patients operated on for senile cataract. After formation of a conjunctival flap the anterior chamber was opened by a puncture made with a Graefe knife at the 12-o'clock position. The incision was then enlarged with scissors. Dr. Hildreth pointed out that the procedure was easy to perform in precisely the same manner at each operation. The analysis of the results in his series showed that the astigmatism averaged 1.75 diopters. Healing was prompt and there was no contraindication for using the scissors extensively on the cornea.

*Discussion.* Dr. B. Y. Alvis said he thought all agreed on the basis of this report and the excellent results obtained. This was a remarkable series because of the visual acuity obtained and the very few complications encountered. Perhaps the incidence of glaucoma may be lowered. He said he had been trained to make a complete section with the Graefe knife

entering on the midline and completing the section. However, many times the iris became involved, aqueous escaped, and the chamber flattened out. As a result of this he began to make a small section and enlarge it.

Among other things tried was a blunt-tipped knife with an edge similar to a cataract knife. This was abandoned because of the difficulties which arose and the use of the scissors was adopted.

He said he makes a small flap, as described by Dr. Hildreth, and then makes an incision, about one-fourth or one-half the anterior chamber at the very tip and one-third at the limbus. The incision is then enlarged with a scissors. In extracting a cataract by the intracapsular method the incision is extended around approximately one-half the limbus. By enlarging the incision and having a good free opening the lens in the capsule can be expelled very readily. At a recent instructional course in Chicago, Kirby stated that he makes almost the full incision with the Graefe knife and enlarges it with the scissors if necessary. He said that such procedure can be followed, if necessary, without hesitancy because the wound will heal just as readily. However, he mentioned that he thinks it will traumatize the tissue more. Dr. Alvis said that shortly after the wounds are healed you cannot see, in examining the sections, any evidence of difficulty. The edges are smooth and well approximated.

The great danger of the puncture and counter-puncture method is the failure to start the knife correctly; in making the counter puncture one either comes out in the cornea or penetrates too deeply into the sclera, and in completing the incision one may get into the visual part or be too deep. There is no doubt but that the keratome incision and Dr. Hildreth's method will avoid that danger. He said that the procedure outlined by Dr. Hildreth is certainly a method much to be preferred

to the attempt to use the full Graefe section.

Dr. F. E. Woodruff said that he, too, had been trained in the old school of doing the Graefe incision but, after seeing the results obtained with the method of enlarging the incision with scissors, abandoned the old procedure. He exercised his preference in using a knife for the small incision instead of a keratome. With this method there is much less astigmatism.

Dr. John Green described the course he follows in cataract surgery. He makes a conjunctival flap and then uses a scalpel or a knife to groove the sclera. This makes the transfixion of the cornea a shorter one and reduces the distance the keratome travels as it passes into the anterior chamber. He then enlarges the incision with blunt scissors. A central suture is placed in the conjunctival flap which may be safely raised by the assistant. He said that his own experience does not bear out the contention that the astigmatism is less with the keratome incision enlarged with scissors. Although he had no statistics to prove it he believed that astigmatism following that type of operation is just about equal to that following a Graefe section.

Dr. T. E. Sanders said that this type of incision is ideal for one not doing extensive cataract surgery. A Graefe section is the most difficult stage of a cataract operation, and, with this method of incision, the operation can be done safely.

Dr. Noland Fisher stated that he had used the Graefe knife in cataract extractions for over six years. He mentioned that one point in favor of making a keratome incision and enlarging it with scissors is the ridge formed by the keratome. A cataract knife comes up from below and it must be turned, as a rule, to come out at right angles with the cornea. The ridge is disadvantageous in getting the iridectomy sufficiently near the base, but,

by raising the flap, this can be done easily. Regarding the type of scissors, Dr. Fisher said he prefers one with a thick blade and having the inside tip blunt to prevent injury to the iris.

Dr. John Hardesty remarked that, 20 years ago, working with Dr. Luedde, they began using the keratome-scissors section for cataract and glaucoma cases. Because of its practicability in selected cases and in unruly patients its use was adopted more and more in ordinary cataract extractions.

#### NONPENETRATING OCULAR INJURY

DR. JOHN GREEN presented three case reports. In each case the patient received a nonpenetrating injury to the eye from an air-rifle shot. In each case an iridodialysis was produced and traumatic cataracts developed later. One of the cataracts was extracted; another one was absorbed spontaneously without operation; and the third cataract was partial permitting the eye to retain fair correctable vision.

*Discussion.* Dr. Adolph Lange stressed the danger in having air rifles where children could have access to them.

Dr. B. Y. Alvis told of a case in which the shot from an air rifle rebounded from a garage and struck a boy in the eye causing a sequence of events similar to those described by Dr. Green. He then reemphasized Dr. Lange's recommendation as to air rifles. He cited cases to show that wearing glasses would protect eyes from the ordinary rifle shot. He said that there were types of air rifles which could be pumped up enough to give the shot velocity sufficient to carry through five-ply veneer wood and kill ordinary game and were much more dangerous than the ordinary type of air rifle.

Dr. Green, in closing, said that he had had other much more disastrous cases of eyes that had been penetrated by air-rifle

shot and had to be removed. He mentioned that air-rifle shots usually contain steel and respond to a magnet and therefore frequently can be removed from an eye. He disagreed with Dr. Alvis in the matter of the protection by wearing glasses unless the lenses were of the non-shatterable type.

James Bryan,  
*Editor.*

#### COLORADO OPHTHALMOLOGICAL SOCIETY

March 20, 1943

DR. JAMES M. SHIELDS, *president*

The Eye, Ear, Nose, and Throat staff of the Fitzsimons General Hospital, Denver, Colorado, presented the following case reports:

#### BILATERAL MULTIPLE SMALL HEMORRHAGES AND LARGE SUBHYALOID HEMORRHAGE IN THE MACULAR REGION OF THE LEFT EYE

Pvt. F. J. T., aged 22 years, had normal eyes, with no history of previous eye trouble until he was given an intraspinal injection of air for a spinogram at a camp, in January. He suddenly lost consciousness and when he recovered he could not see well with either eye. The right eye improved but the left remained unchanged. The vision was R.E. 20/20; L.E. 1/200. When last seen he had multiple small discrete round hemorrhages in the left eye as well as a large round hemorrhage involving the macular area, and there were a few small hemorrhages in the right eye.

#### DEEP KERATITIS, CAUSE UNDETERMINED

Seaman 2c T. R. R., aged 17 years, was admitted to the Hospital on March 13, 1943. The first indication of trouble with

his eye had begun three weeks previously; when the right eye became inflamed and sensitive to light. The vision was R.E. 20/100; L.E. 20/15. All laboratory findings were normal, including serology tests, and X-ray studies of the chest. He experienced no severe pain, except that caused by bright light.

**SYMBLEPHARON, PSEUDOPTERYGIUM, LEUCOMA, AND DIVERGENCE OF THE RIGHT EYE**

Pfc. K. C. G., aged 26 years, gave a history of having suffered a burn of the right eye in a gasoline explosion 21 years ago. The vision was R.E. light perception; L.E. 20/15. The pupil could be seen to react to light through the corneal scar. On March 9, 1943, an operation was performed, consisting of plastic repair of the conjunctival surfaces of the lids, and peeling of the superficial layer of the cornea. X-ray therapy was instituted March 10th, and was repeated the next three days. A total of one erythema dose was given. Riboflavin and cevitamic acid were administered by mouth.

**BILATERAL PRIMARY OPTIC ATROPHY—RIGHT TEMPORAL HEMIANOPSIA**

N. E. L. complained of headache and visual disturbance of 2- to 4-years' duration. The vision was R.E. 20/70; L.E. 20/25. Visual-field studies showed a right temporal hemianopsia. Operation which was done September 18, 1942, revealed a hemangioblastoma of the sella turcica.

**BILATERAL CHOKED DISCS**

Pvt. W. J. P., aged 23 years, noticed failing vision in the right eye of one month's duration. He reported to sick call because of poor vision. He did not complain of headaches. After examination a diagnosis of suprasellar brain tumor was made.

**VITREOUS HEMORRHAGE, SPONTANEOUS**

Pvt. A. L., aged 22 years, gave a history of blurred vision in the right eye beginning on February 6, 1943. The vision, prior to the onset of this attack, was 20/20 in the right eye. Because there was no other complaint he did not report to sick call until February 8, 1943. At that time he could recognize only moving objects and light. There was no history of trauma, exertion, nor alcoholic drinking. He had been transferred to this Hospital on March 6, 1943. When last seen there was light perception in the upper nasal portion of the field. The tension was 22 mm. (McLean). The blood pressure was 120/72. Examination of the heart revealed no abnormalities.

**UNILATERAL PROPTOSIS**

Pvt. F. K. L., a 34-year-old Chinese soldier, was admitted to the Hospital on January 4, 1943. He complained of diplopia on looking up or down. The condition had been present since November, 1942. There was moderate edema of the lids of the left eye, but no pain and only moderate tenderness. He was afebrile. Maximum proptosis was reached in January, 1943, and exophthalmometric readings were: R.E. 17; L.E. 21. Visual-field studies revealed no defects. The fundus was normal in each eye. The vision also was normal. B. M. R. was +14. X-ray examination of the left orbit on December 15, 1942, at the Station Hospital, La Junta, Colorado, showed questionable erosion of the medial surface. Three subsequent X-ray pictures here failed to confirm any pathology in the orbits. There was some clouding of the ethmoids. The ocular rotations were grossly normal. Diplopia was heteronymous with left hyperphoria. There was a gradual return to normal, although some residual fullness remained on the left side of the face.

# PLASTIC REPAIR OF LATERAL MARGINS OF UPPER AND LOWER LIDS AND RECONSTRUCTION OF OUTER CANTHUS

Sgt. P. W., aged 24 years, suffered a severe lye burn to his left eye and lids when he was three years old. The eye was enucleated at that time and the socket was lined with split-skin graft. The upper and lower lid defects were not repaired and because of this he was unable to retain a prosthesis. On February 23, 1943, a pedicle skin graft from above the eyebrow was brought down and anchored to the upper-lid defect. On March 15, 1943, the pedicle skin graft was split toward the base and reversed to be approximated to the lower-lid defect. Later the pedicle will be severed and the skin will be split along the margin of the outer canthus and skin edges will be approximated.

Pvt. R. W. S., aged 30 years, had his left eyeball enucleated on August 10, 1942, when the globe was ruptured and other injuries were sustained when a land mine exploded near him. The globe was removed and the orbit was packed with vaseline gauze and sulfanilamide. Considerable scarring of the orbital tissue remained along with a loss of substance and contraction of the nasal portion of the upper eyelid. The conjunctival sacs were almost obliterated by adhesions and scarring. On January 8, 1943, under pentothal sodium anesthesia, the scars and adhesions were dissected loose and the medial portion of the upper lid freed from its scar bed and inserted into its normal anatomic position. The orbit was packed with gauze. The patency of the conjunctival sacs did not persist and on February 10, 1943, under similar anesthesia, dissection was carried out well into the upper outer part of the orbit and the lower sac dissected free. A stent of dental molding wax was made to fit into the orbit and around this was wrapped a split-skin graft taken from the right thigh.

The graft had taken well and the patient was soon fitted with a larger prosthesis than was required for the purpose of preventing any further contraction deformity in healing.

Walter A. Ohmart,  
*Secretary.*

## MEMPHIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

April 12, 1943

DR. C. HAYS GLOVER, *presiding*

### CONGENITAL BLEPHAROPTOSIS AND SIMULATING CONDITIONS

DR. PHILIP M. LEWIS reported three cases of congenital blepharoptosis, each patient operated upon by the method that seemed best suited to the individual. Kodachrome slides were shown of each case before and after operation.

*Case 1.* J. D. H., aged five years, had had a drooping of the right upper eyelid all her life and the eye was also crossed. The eyelid covered the upper two thirds of the cornea; there were 30 prism diopters of esotropia and a definite limitation of motion of the right eye up and out. There was no tendency to raise the lid by elevation of the brow. Resection of the levator was performed and also recession of the internus and resection of the externus. A slight undercorrection of the ptosis at the outer extremity remained, but the improvement was definite.

*Case 2.* R. C., aged six years, had had a drooping left upper eyelid all his life. The lid covered slightly more than the upper half of the cornea. There was no action of the levator muscle, and the lid could be lifted only very slightly by means of raising the brow. As the superior-rectus action was good, a Mouton opera-



tion was performed. A marked over-correction resulted, and the eyeball was turned down badly. One week later a "reversed Motais" operation was performed. The tongue of muscle was freed from the lid and divided antero-posteriorly. The posterior portion was reattached to the stump whence it came, and the anterior half attached to the surface of the tarsus. The result was excellent.

Case 3. E. S., aged five years, had had a drooping of both upper eyelids all his life. Two thirds of the corneas were covered except when he made a strong effort to raise the lids by elevating the brows. It was noticed that he did this most of the time, which along with a tilting of the head backward enabled him to see to get about. A bilateral Reese ptosis operation was performed, which utilized dissected strips of orbicularis muscle to connect with the frontalis muscles of the brows. Both the cosmetic and functional results were highly satisfactory.

Dr. Lewis reported a case of the Marcus Gunn, or jaw-winking phenomenon, and also a case of blepharochalasis, both of which simulated ordinary ptosis. Kodachrome slides were shown, with a discussion of the treatment of these interesting conditions. A slide of a patient with Horner's syndrome was shown because of the moderate ptosis present.

#### CATARACT EXTRACTIONS, HEMORRHAGE, PROLAPSE, AND GLAUCOMA

DR. E. C. ELLETT reported a case of cataract complicated by postoperative hemorrhage, iris prolapse, and secondary glaucoma. Mr. C. was first examined in 1912 at the age of 50 years. His eyes were normal. The vision, R.E., was 20/20 with +1.75D. sph.  $\approx$  +1.50D. cyl. ax. 180°; L.E., 20/20, with +1.25D. sph.  $\approx$  +1.00D. cyl. ax. 180°. With a suitable

addition he read J1. He was examined again 10 years later, and there was very little change in the refraction. The vision was still 20/20 and J1, but he had a beginning cataract in the right eye, in the shape of a spicule up and out.

In 1928 the vision in the right eye was 20/100, improved to 20/30 with -0.50D. sph.  $\approx$  +2.25D. cyl. ax. 180°. The vision in the left eye was still 20/20. The lens opacity had increased, and there was a slight opacity in the left eye. The pupils, tension, and fundi were normal.

In 1929 the best vision in the right eye was 20/80 with -2.00D. sph.  $\approx$  -1.50D. cyl. ax. 90°. The vision in the left eye was still normal.

In 1932 the vision in the right eye was 3/200 and in the left eye 20/20.

In 1934 the vision in the right eye was light perception. The vision in the left eye was 20/20 and J3, but the refraction was -0.50D. sph.  $\approx$  -2.25D. cyl. ax. 90°. The cataract in the right eye was mature.

On November 24, 1934, the lens was extracted from the right eye—a simple intracapsular operation, a peripheral iridectomy having been done. The patient was then 72 years old. The day after the operation the patient got out of bed and pulled off his mask. The iris prolapsed, and was cleanly excised the same day, and the pillars dressed back. On the fourth day the stitch was removed. On the next day, he coughed and had a hemorrhage in the anterior chamber, but the wound was firm. He developed an atropine dermatitis which disappeared when duboisin was substituted for the atropine. On December 28th, the vision was 6/7.5 with +11.00D. sph.  $\approx$  +4.50D. cyl. ax. 15°, and with a suitable addition he read J1.

In June, 1938, he returned for a check up. Vision in the right eye was 6/7.5 and J2 with glasses. The optic nerve showed

a large cup, not definitely pathologic, with steep, nasal sides, but shelving to the temporal side. The tension was 43 mm. Hg (Schiötz). The pupil was large, feebly active, and there was a dot of pigment in the wound over the root of the temporal pillar of the coloboma. Eserine reduced the tension, and the patient continued to use it until his recent death. Tension rose occasionally, and the nerve became more cupped, but in February, 1943, the tension was 26 mm., vision 6/12 and J3. The visual fields were never very satisfactorily recorded, because of the cataract lenses, but there seemed to be a nasal contraction to 20 degrees.

The left eye developed a cataract and was operated on on February 19, 1941. This was after glaucoma had developed in the right eye, but the tension was never elevated in the left eye. A combined intracapsular extraction was done. Vitreous came into the anterior chamber, but none was present in the wound. The next morning, although there had been no pain at all, the dressing was found saturated with blood, and a mass of clot and presumably ocular contents protruded between the lids. Choroidal hemorrhage was more than suspected, but on close inspection, the hemorrhage was found to be superficial, and the mass was only a clot attached to the wound. The clot was

cut off and much blood was found in the anterior chamber. The nasal half of the wound was slightly separated, but the stitch was removed on the 14th day and the patient left the hospital on the following day. Clearing of the eye was slow, as there was blood in the anterior and vitreous chambers, and a high degree of astigmatism resulted. It was nearly a year before the best vision was obtained. This was 6/12 with +7.00D. sph.  $\approx$  +10.00D. cyl. ax. 10°. A cystoid condition of the scar in the left eye was treated with trichloroacetic acid in June, 1941, for several weeks, with a resultant flattening of the wound. The tension never rose in the left eye, and the fundus was well seen a few months after the operation. The last examination, made a month before the patient's death, was as follows: R.E. vision 6/12 with +11.00D. sph.  $\approx$  +5.00D. cyl. ax. 15°; L.E., vision 6/12 with +8.00D. sph.  $\approx$  +10.00D. cyl. ax. 10°.

With both eyes the vision was 6/9—. He read J3, R.E., and J4, L.E., with glasses. The tension was R.E. 26 mm. and L.E. 22 mm. The patient died in March, 1943, aged 81 years.

The interesting features are the preservation of useful vision in the right eye with miotics, and the happy error in regard to the nature of the postoperative trouble in the left eye.

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## PUBLIC RELATIONS

Most of those who study medicine do so because they want to practice medicine, a few because they are interested in research, a small minority because they have an interest in administration, but almost no one has a desire to involve himself in medical politics.

The usual pattern for making an ophthalmologist is for him to get as good an education as he can afford and is capable of absorbing and then to enter the practice of his specialty as a clinician. If his training has been broad and sound he is interested in research and possibly will

be inclined to try his hand at it, if he finds the time. At least, he subscribes to a scientific journal or two and glances through most issues hurriedly when they arrive; he may even give up the time necessary for reading an entire article if it happens to catch his fancy. He joins the local medical society and attends fairly regularly while building his practice, in the end concerning himself with the ophthalmic section only, if he is so fortunate as to live in a city where such exists—if not, he may attend an occasional meeting of the general society to hear a paper that has some bearing on his specialty.

He may step out of his role to try to snare a little industrial work if that type of practice appeals to him and especially if he has no serious objections to appearing before commissions and judges. This is as far from the strict practice of medicine as most doctors care to roam, and because of this somewhat ingrowing tendency medicine has found itself out of touch with current trends of thought with regard to the lay attitude about the practice of medicine and, what is more, does not have ready access to those laymen who control many matters that directly concern the physician.

A good example of this relative negligence is found in connection with municipal school boards. The ophthalmologist has a real interest in the care of children's eyes. Parents expect to get advice through the school physicians as to the health of their children. The ophthalmologist knows this very well and is aware that he or some of his confrères who are competent should have a guiding voice in all that pertains to vision in the schools. Even if he has a sense of responsibility he does not feel called upon, nor is he even sure of the ethics in question, to offer his services as a consultant. But it may well be that the school board does not know where to turn and so enlists the aid of someone who is not broadly educated or does not have the welfare of the child as his first concern.

This is only one example of a possible failure to coöperate with laymen in subjects of concern to both laymen and doctors. Another might be a question of legislation. The ophthalmologist may have a clear idea of what is good and what is bad, but if he does not try to find out what laws are pending, action may have been taken long before he has even heard of them. The fact is that, being constructed as he is, he does not trouble himself to investigate these things on his

own initiative, and one bad law after another may be passed before he finally awakens to the fact that his hands are being tied while he did not even realize that anyone was making plans to bind them.

Many years ago the writer saw this happen in his own state, and, in fact, was made keenly aware of the necessity of preparedness in matters of legislation. Asked by the president of the local medical society to go to the state capitol to appear before a committee of the House of Representatives to plead a medical cause that he knew to be good, and being then young and very ingenuous, he consented to go, with the idea that because his cause was good it would prevail. A friendly member of the committee told him that he might as well make his talk, since he had come all the way to the state capitol to do so, but that the vote against him would be almost 100 percent because the opposition had been installed in the capitol for three months and had entertained the members very liberally and had been very persuasive in their arguments. May I add that he was not a false prophet.

That affair rankled for 25 years, but a clear answer as to how to combat this type of thing has not appeared. However, even if the specific answer has not been forthcoming certain points are obvious.

In the first place, we no longer dare to push these political and sociological matters aside and say, "Oh, let someone who is interested take over the job." It is *our* job, not that of someone else.

What actually can the individual do? Standing alone, he can accomplish almost nothing. But he does belong to medical organizations, not only to national societies that are so big that the little fellow feels lost in them but also to his own county society and perhaps to a specialty society in his home town. There, at least, he has a voice that commands respect,

and right there he can begin by insisting on the creation of a standing committee the sole duty of which shall be to investigate all political and sociological matters that concern ophthalmologists, as such, in his city and state, and to inform the members of the society of these things, so that prompt and appropriate action may be taken. When there is a change in administration, those who will be in charge of ophthalmic matters should be approached and the position of the society made clear concerning points of mutual interest in their related fields. The great advantage of this set-up is that it involves not the initiative of an individual but of a group. No one is pushing himself for-

ward, but as the authorized agent of a recognized society he is acting at the request of the organization. It cannot be doubted that most administrations want sound advice; if, therefore, representatives of reputable and relatively disinterested groups seek to discuss with them subjects that come within their specific fields of knowledge, they will surely be given a hearing.

This method has applications far beyond the specialty society. If applied generally in medicine all doctors would know more about their public relations and would be far more important factors in the medical future of their communities.

Lawrence T. Post.

# ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

## CLASSIFICATION

- |  |  |
|--|--|
| 1. General methods of diagnosis                        | 10. Retina and vitreous                                |
| 2. Therapeutics and operations                         | 11. Optic nerve and toxic amblyopias                   |
| 3. Physiologic optics, refraction, and color vision    | 12. Visual tracts and centers                          |
| 4. Ocular movements                                    | 13. Eyeball and orbit                                  |
| 5. Conjunctiva   | 14. Eyelids and lacrimal apparatus                     |
| 6. Cornea and sclera                                   | 15. Tumors   |
| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries   |
| 8. Glaucoma and ocular tension                         | 17. Systemic diseases and parasites                    |
| 9. Crystalline lens                                    | 18. Hygiene, sociology, education, and history         |
|  | 19. Anatomy, embryology, and comparative ophthalmology |

### 1

#### GENERAL METHODS OF DIAGNOSIS

Irvine, S. R. A simple test for binocular fixation. Clinical application useful in the appraisal of ocular dominance, amblyopia ex anopsia, minimal strabismus, and malingering. *Amer. Jour. Ophth.*, 1944, v. 27, July, pp. 740-746. (References.)

Pereyra, L. S. A practical substitute for homatropine in examination of the media, fundus oculi, and refraction. *Arch. de Oft. de Buenos Aires*, 1942, v. 17, Aug., p. 498.

In 150 patients, the author experimented with solutions of atropine sulphate of different strength. He found the 1 to 10,000 solution to be a practical mydriatic, and he arrives at the following conclusions: (1) Mydriasis is complete in 100 percent of the cases. (2) It takes from a half to one hour to produce mydriasis. (3) There is no dazzling. (4) Accommodation is not paralyzed. (5) There is no increase in intraocular tension. (6) The average duration of mydriasis is 2 hours.

Plinio Montalván.

Roper, K. L., and Bannon, R. E. Diagnostic value of monocular occlusion. *Arch. of Ophth.*, 1944, v. 31, April, pp. 316-320.

Interference with binocular vision by occlusion of one eye may prevent asthenopic symptoms resulting from heterophoria, aniseikonia, or disturbances of the accommodation-convergence relationship, as well as doing away with the necessity for many fine adjustments on the part of the neuromuscular apparatus concerned in binocular vision. While monocular occlusion has been used largely as a means of discovering latent heterophoria, the authors suggest that it be used to determine whether any of the various binocular anomalies are at fault.

Eighty selected patients at the Dartmouth Eye Institute were tested by monocular occlusion. Of this number, 56 derived some relief during occlusion. It was found that those so relieved had an eight to ten chance of obtaining ocular comfort by correction of heterophoria or aniseikonia or both. As many of the patients had

been referred originally for relief of aniseikonia, it was natural for this condition to be encountered more frequently than in average practice.

For the test to be of value, occlusion of one eye should be maintained for at least two weeks. Different types of occluders are described. The best is one which is attached by suction to the back of the lens and fits around the orbit. The most inconspicuous occluder is an opaque contact glass. (6 photographs, references.)

John C. Long.

Swan, K. C., and White, N. G. Di-n-butylcarbaminoylethylcholine sulphate. A new cycloplegic and mydriatic drug. *Arch. of Ophth.*, 1944, v. 31, April, pp. 289-291.

The authors have synthesized a new class of choline esters with mydriatic and cycloplegic properties. By replacing the  $\text{NH}_2$  group in doryl with di-n-butylamine, a new surface-active derivative is obtained which has an atropinelike effect on the parasympathetic nerves. The most promising of the new class of esters is di-n-butylcarbaminoylethylcholine sulphate. This occurs as white, slightly hygroscopic crystals. It is practically odorless but has a bitter taste. It may be synthesized by a relatively simple method from inexpensive and readily available chemicals. Solutions of the drug are fairly stable at room temperature if protected from light and alkalis. The drug has some antiseptic properties, and is relatively nonirritating, although repeated instillation of a 5 to 7-percent solution may cause transitory punctate disturbance in the corneal epithelium. Most patients found solutions of 5-percent homatropine hydrobromide and of 7.5 percent di-n-butylcarbaminoylethylcholine sulphate about equally irritating, al-

though congestion of the conjunctival vessels was more pronounced after use of homatropine.

The new drug has been used in the eyes of over 700 patients. The intensity of cycloplegia and mydriasis produced by a 7.5-percent solution of the drug was found to be equivalent to that produced by 5-percent homatropine but of shorter duration. There appears to be less danger of creation of a rise of intraocular pressure with the new drug than with homatropine. No toxic systemic effects have been observed from the ocular use of the drug, nor have there been any allergic reactions. The authors state that while di-n-butylcarbaminoylethylcholine sulphate is the most promising of the new cholinergic derivatives which have had extensive clinical trial, the possibilities for development of more effective derivatives in this new field have not been exhausted. (2 figures, references.)

John C. Long.

Weiss, Charles. Laboratory aids in the diagnosis of infections of the eye prevalent in tropical and subtropical countries. *Amer. Jour. Clin. Path.*, 1944, v. 14, April, pp. 200-213.

The author asserts that inclusions associated with blennorrhoea of the new-born, with swimming-bath conjunctivitis, and with Samoan conjunctivitis cannot be distinguished by inspection from those of trachoma. In ocular lymphogranuloma venereum, diagnosis may be made with the Frei skin-test and the complement-fixation reaction. In epidemic keratoconjunctivitis, conjunctival scrapings show a lymphocytic exudate with an occasional large mononuclear cell. Herpes material inoculated into the rabbit cornea may produce encephalitis. Biopsy is useful for recognition of



molluscum bodies. In rickettsial diseases diagnosis is aided by agglutination tests employing the patient's serum and various strains of *Proteus* as antigen. Agglutination reactions are also mentioned for oculoglandular tularemia and Weil's disease; complement fixations for lymphogranuloma venereum, gonorrhea, and syphilis; and the skin test for tuberculosis. The following classifications are amplified: virus diseases; bacterial infections; ocular manifestations of systemic diseases; mycotic diseases; infections of cornea, iris, and other tissues; protozoa; animal parasites; and insects. The ocular and geographic locations in the last section are detailed.

Charles A. Bahn.

## 2

### THERAPEUTICS AND OPERATIONS

Cashell, G. T. W. Penicillin for ocular infections. *Brit. Med. Jour.*, 1944, March 25, p. 420.

The author reports the successful use of penicillin drops in external ocular infections and perforating injuries. Patients with chronic blepharitis and acute conjunctivitis responded to local administration of penicillin, sterile cultures and clinical cures being obtained in five to twenty days. In most cases, the organism cultured was *Staphylococcus pyogenes*. Corneal ulcers also responded well. Several patients showed prompt improvement in dacryocystitis after five to nine days of treatment.

The preparations used contained 500 Oxford units per c.c., for the drops, and 500 Oxford units per gram, for the ointment. The drops were given every four hours, or three times a day, except in perforating injuries, where they were used every half hour for 24 hours, then every two hours through

the second day. Instillation into the anterior chamber was practiced in some cases of injury. The author suggests continuing treatment for seven days after clinical cure or after sterile cultures are obtained.

Benjamin Milder.

Paulo, A., Jr., and Arruda, J. de. Contribution to the study of indications for retrobulbar injection of alcohol. *Rev. Brasileira de Oft.*, 1944, v. 2, March, pp. 153-160.

Two illustrative cases are briefly described. In one the pain was postherpetic, in the other it had followed violent contusions with hematoma of the anterior chamber and severe intraocular hypertension. The author uses a preliminary injection of 1 c.c. of 1 or 2 percent novocaine, and follows this, through the same needle, with an injection of 1 c.c. absolute or 80 percent alcohol, administered slowly. He injects more of the novocaine solution during withdrawal of the needle. (References.)

W. H. Crisp.

Sharma, B. C. Retrobulbar injection of alcohol in painful blind eyes. *Indian Jour. Opth.*, 1944, v. 5, Jan., pp. 6-10.

Four case histories are recorded to illustrate the value of retrobulbar injection of 1 c.c. of 50-percent-alcohol solution for painful blind eyes.

W. H. Crisp.

Wong, W. W. Penicillin and gramicidin as ocular chemotherapeutic agents. *Arch. of Opth.*, 1944, v. 31, Feb., pp. 165-169.

The history, method of preparation, known chemical facts, and probable method of action of penicillin are summarized. At the time of this review, only four cases of ocular disease treated with penicillin were found. A patient with a corneal ulcer due to

*Staphylococcus aureus* was treated by a continuous bath of a solution of sodium penicillin. Eight days after initial use of the drug the cornea no longer stained with fluorescein. The second case was of an infected cigarette burn of the cornea. This lesion healed in approximately four days after continuous application of the drug by means of the Standard bag. The third case was one of corneal ulcer following a foreign body. Healing required ten days after application of penicillin. The fourth case was one of acute mucopurulent conjunctivitis. There being no improvement after two days of conventional treatment, penicillin drops were used, and in five days the eye was regarded as healed. From these cases it is concluded that the use of penicillin resulted in rapid relief of pain and resolution of inflammation in certain ocular conditions, without any harmful effects on the eye. Observations on the effect of penicillin in experimental eye infections have been quite encouraging.

Dubos has produced, from cultures of *Bacillus brevis*, a substance which is extremely toxic to gram-positive bacteria. This product may be separated into two components, gramicidin and tyrocidin. The mixture of these substances is known as tyrothricin. The preparation is too toxic for intravenous injection and is safest applied locally. The results from tyrothricin in ocular infections have been disappointing. (Bibliography.) John C. Long.

## 3

PHYSIOLOGIC OPTICS, REFRACTION,  
AND COLOR VISION

Brozek, J., and Keys, A. Flicker-fusion frequency as a test of fatigue. *Jour. Industrial Hygiene and Toxicology*, 1944, v. 26, May, p. 169.

The flicker-fusion frequency (flickers per second at which an interrupted light appears as steady light) has been measured under various conditions. Under standardized conditions, equal results were attained. The frequency did not change with practice, and was not affected by one hour of treadmill marching. It decreased but slightly from day to day when subjects were working to the limit of capacity in a temperature of 120°F. It did, however, decrease noticeably from day to day on a regimen of hard work and total caloric starvation.

The authors conclude that although flicker-fusion frequency changes when the organism is exposed to intensive strain yet, since the change is small, flicker-fusion frequency can not be considered a sensitive indicator of general fatigue. R. Grunfeld.

Crozier, W. J., and Wolf, E. Theory and measurement of visual mechanisms. 11. On flicker with subdivided fields. *Jour. Gen. Physiology*, 1944, v. 27, May, p. 401.

Flicker contours for a square image, with light sectorized at a focus, are strikingly modified if the same illuminated area is arranged in four squares separated by a narrow opaque cross. This arrangement produces, in part, only the changes in flicker contour which the authors have labeled as pecten effect. The significant factor in producing the latter is not so much the pulsatile interruption of light but the change in contrast brought about by the moving contact of light-dark borders which is produced with light not sectorized at a focus but with bar images moving across a field with inclined fixed opaque bars.

R. Grunfeld.

Harman, N. B. Eyesight . . . and glasses. *The Practitioner*, 1944, v. 152, Feb., pp. 65-70.

Exercise the eyes but do not wear glasses, is the theme of a recent work by Huxley, reviving the fantasies of Bates. Harman explains that the need of glasses depends on the shape of the eyeball, which obviously cannot be changed by exercises of any sort. The question, "Will any sort of exercises benefit our eyes and enable us to do without glasses" can be answered with an unqualified "No." The fantasies of Huxley, however, must not be confused with sight-saving classes and orthoptic training. In sight-saving classes, those with poor sight are educated how to use their eyes and save them. In orthoptics, exercises are used to help regain a normal interaction of unbalanced external eye muscles. In both, however, the use of glasses is practically imperative. The use and effect of persuasion as a temporary expedient cannot be overemphasized. It increases the momentary urge to see better and minimizes the fear of sight failure. Its applications are many and varied in the field of eye exercises. Among these are looking at the sun to strengthen the eyes. Except possibly in the practically blind, this foolish practice can only be harmful, permanently damaging the macula. Another silly practice is blinking as a conscious effort, whose only possible virtue is slight development of visual memory. Charles A. Bahn.

Hymes, Charles. The correlation of the phenomena of crossed and obliquely crossed cylinders with cylinder retinoscopy and clinical refraction. *Trans. Amer. Acad. Ophth. and Otolaryng.*, 1943, 47th mtg., July-Aug., pp. 454-459.

Formulae are given for finding the power of a cylinder at any meridian,

and the strength of the spherocylindrical equivalent of obliquely crossed cylinders. Three rules as to obliquely crossed cylinders are noted, with their application in cylinder retinoscopy and in the use of the cross cylinder in refraction. The conclusions are that the same physical and physiologic basis applies to the technique of the cross cylinder and that of cylinder retinoscopy, and that the cross cylinder may be used to determine the amount and axis of an astigmatism but not the power of the spheres nor of the spherical addition for presbyopia. (3 figures, references.)

Katherine H. Chapman.

Jaecle, C. E. Practicability of use of contact lenses at low atmospheric pressures. *Arch. of Ophth.*, 1944, v. 31, April, pp. 326-328.

Present military aviation requires that crew members have good vision without glasses. The use of ordinary spectacles is considered impractical. The author conducted experiments to determine whether contact lenses could be used practically in airplanes at the altitudes commonly attained in modern warfare.

Eleven observations were made in a pressure chamber on 10 persons who were accustomed to contact lenses. Four persons subjected to pressure equivalent to that of an elevation of 10,000 feet showed no signs or symptoms. Of four persons subjected to pressure equivalent to an altitude of 18,000 to 20,000 feet, two had bubbles under the lenses, one in one eye and the other in both eyes. Of six persons who were subjected to pressure equivalent to that of an elevation of 18,000 feet or over, five had bubbles under at least one lens. While the presence of bubbles was not always associated

with demonstrably lowered visual acuity, the subject was aware of clouding of the vision. In view of the rather consistent results, the author concludes that wearers of contact lenses will probably have bubbles under their lenses with diminution of vision when subjected to pressures equivalent to elevations of 18,000 feet or more.

John C. Long.

Klein, M. Retinoscopy in astigmatism. *Brit. Jour. Ophth.*, 1944, v. 28, May, pp. 205-220.

The importance of the systematic use of cylinders in retinoscopic tests of astigmatic eyes is emphasized and the effects of obliquely crossed cylinders in retinoscopy are given in tabular form. The advantages of the streak retinoscope for checking axis and amount of astigmatism are explained and the method of examination with this instrument is given in detail. (One table, references.)

Edna M. Reynolds.

Klein, M. Principles of retinoscopy presented on the basis of the theory of projection. *Brit. Jour. Ophth.*, 1944, v. 28, April, pp. 157-176.

The effects of mirrors and lenses on an optical system are reviewed and diagrammed. Retinoscopy is considered as an aperture test for determining the point of reversal of a myopic eye or of an eye made myopic by trial lenses. The examined eye is regarded as an apparatus which projects a beam of light toward the observer. Factors determining the speed of the reflex movement and the point of reversal are analyzed. (16 figures, references.)

Edna M. Reynolds.

Mann, I., and Archibald, C. A study of a selected group of women employed

on extremely fine work. *Brit. Med. Jour.*, 1944, March 18, p. 387. (See Section 18, Hygiene, sociology, education and history.)

Masor, P. L. Axis finder chart. *Arch. of Ophth.*, 1944, v. 31, April, pp. 335-336.

The author employs streak retinoscopy (Copeland) as a means of objectively determining astigmatism. Using spheres only and rotating the streak produced by the retinoscope, the position of the streak neutralizing the greater refractive error determines the axis of the cylinder. The author proposes that an axis chart be suspended above the head of the patient so that, after carrying out the retinoscopy, the streak may be projected on the chart, thereby easily locating the axis of the astigmatism. (2 figures.)

John C. Long.

Olmsted, J. M. D. The role of the autonomic nervous system in accommodation for far and near vision. *Jour. Nervous and Mental Dis.*, 1944, v. 99, May, p. 794.

The author has conducted a series of experiments to demonstrate the fact that the ciliary muscle behaves in the same manner as do other autonomically innervated tissues. It has both sympathetic and parasympathetic innervation, and these produce opposite effects, the former causing contraction of the radial ciliary fibers, flattening the lens; the latter, by contraction of the circular fibers, causing increased curvature of the lens.

Refractions have been performed on many kinds of laboratory animals, and in every case stimulation of the cervical sympathetics has produced increased hyperopia of +1.00 D. to +6.50 D. This same effect is obtained

with the oculomotor nerve severed, and with the extrinsic muscles cut. The findings were further corroborated by photographing the Purkinje images. In every case, the myopia produced by third-nerve stimulation was greater than the hyperopia produced by stimulation of the cervical sympathetics.

When the oculomotor nerve of a cat's eye was removed, the eye became permanently more hyperopic. In humans, too, a sudden shock, causing multiple evidences of sudden sympathetic stimulation, was accompanied by momentary hyperopia. When each of the four long ciliary nerves was stimulated, there was an induced astigmatism, leaning away from the nerve stimulated, indicating that some of the radial fibers of the ciliary muscle are stimulated by each of the long ciliary nerves, so that the entire smooth muscle did not necessarily react as a unit. Benjamin Milder.

Pendse, G. S. The problem of myopia. *Indian Jour. Ophth.*, 1944, v. 5, Jan., pp. 11-13.

The author proposes to gather a statistical record of myopia, in order to study the comparative importance of all the various factors, social, familial, and personal, involved in the genesis and progress of the disease. He has therefore prepared an information chart, reproduced with this article, and the form of which he asks readers to follow in collecting case records. Copies of the chart are obtainable from the author at Poona City, India. Among the details included are those as to social origin, standard of living, ocular condition, general condition, and heredity.

W. H. Crisp.

Shukla, K. N. Myopic families. *Indian Jour. Ophth.*, 1944, v. 5, Jan., pp. 1-5.

The author has studied, so far as the records would permit, the refractive conditions of many members of each of a number of families. Obviously, the information became less reliable in dealing with antecedent generations, and in some cases children below five or six years of age could not be examined because the parents objected to the use of atropine in the children's eyes. Without possibility of important statistical conclusions, the author gives examples respectively of pedigrees in which both parents were myopes, in which the father alone or the mother alone was myopic, in which both grandparents were myopic, and in which only one grandparent was myopic.

W. H. Crisp.

Swan, K. C., and White, N. G. Di-n-butylcarbaminoylecholine sulphate. *Arch. of Ophth.*, 1944, v. 31, April, pp. 289-291. (See section 3, Physiologic optics, refraction and color vision.)

Turner, H. H. The etiology and control of progressive axial myopia. *Pennsylvania Med. Jour.*, 1944, v. 47, May, p. 793.

This article contains many charts and diagrams. Turner has been interested in the chemical imbalance of the various structures which make up the eye, and in the effect upon function. He believes that such imbalances lie behind certain forms of congestive glaucoma as well as progressive axial myopia. The physiologic chemical balance of the human tissues is a matter of particular importance in relation to the eye. The author believes control of progressive nearsightedness to be ef-

fective, although the ophthalmologist must have intelligent and understanding coöperation by internists and nose and throat specialists.

Theodore M. Shapira.

Williamson-Noble, F. A. *Contact lenses*. *The Practitioner*, 1944, v. 152, Feb., pp. 82-87.

Contact glasses were first suggested in 1801, but their practical use only began about 1911. Early contact glasses were without focal power, and the scleral portion was ground on a spherical curve which practically limited their use to hypermetropes. Later, a mold of the anterior surface of the eye was perfected by Dallos, using a hydrophilic colloid, negocol. The modern tendency is to use a stock mold without optical power. An expert contact-lens fitter usually requires but a few minutes to grind away the pressure areas. Twenty or more attendances may be required, however, before a satisfactory result is obtained. Contact glasses require more or less extensive training for their successful use. First is the irritative stage. Later a halo of colored lights, Sattler's veil, is often noted. This occurs one to three hours after insertion of the contact glass and ceases ten to thirty minutes after its removal. A midday break of about one hour without the contact glass is advisable. Contact glasses have the major advantage of moving with the eyeball, of minimizing curvature irregularities, and of fitting closer to the eyeball than spectacle lenses, which is of value in monocular cataract. Plastic contact glasses which have the advantage of not breaking easily are still in the experimental stage.

Charles A. Bahn.

## OCULAR MOVEMENTS

Adrogué Esteban. *Ocular nystagmus*. *Rev. Oto-Neuro-Oft.*, 1943, v. 18, March-April, pp. 49-55; and May-June, pp. 79-84.

The author calls ocular nystagmus an associated "temblor" of the eyes; an involuntary, rhythmic, almost always bilateral oscillation of the eyes in the same direction. Before discussing ocular nystagmus, he reminds us of the so-called "rest-point" of the eyes (in repose)—somewhat divergent and up. Latent nystagmus may be provoked by occluding a good eye and having the patient use an amblyopic eye. Congenital, known as true optic or ocular nystagmus, is rarely associated with vertigo, the eyes may oscillate even under the closed lids, and there may be an accompanying spasmus nutans. Blindness or very poor vision is usually present, due to such a congenital defect as disease of the optic nerve, uveal coloboma, lens luxation, or microphthalmos. Heredity plays an important role, and bright light augments the rapidity and amplitude of the oscillations. Acquired spontaneous nystagmus follows violent visual efforts such as typesetting or painting, and disappears when the provocative cause is removed. Coal-miner's nystagmus is attributed to poor illumination.

The causative factors are represented in the following classifications: (1) miner's (horizontal, vertical, and oblique); (2) febrile diseases, due probably to posterior-fossa involvement; (3) chemical intoxications; (4) frontal-lobe injuries; (5) intracranial disease; (6) multiple sclerosis; (7) other neurologic diseases including familial ataxia, mongolism, syringo-

myelia, and craniofacial dysostosis; (8) unilateral nystagmus where the affected eye has poor vision as compared with its fellow; (9) spontaneous voluntary nystagmus; (10) spasmus nutans. In cases of the nonpendular type of nystagmus (slow and rapid phases), we are dealing with vestibular, commissural, or cerebellar lesions. In addition to nystagmus, acoustic lesions are almost always associated with vertigo and rarely with nausea or emesis. The latter two symptoms are usually indicative of increased intracranial pressure from expanding brain lesions. Cerebral tumors rarely cause nystagmus. Cerebellar injuries are frequently associated with transitory conjugate deviations. Cerebello-pontine angle tumors also provoke involuntary ocular movements among other symptoms.

In conclusion, the author advises us not to err in cases of normal nystagmoid movements of extreme lateral gaze, and he also notes a congenital type of nystagmus due to paresis of conjugate movement.

Edward Saskin.

Argañaraz, Raúl. The surgical treatment of vertical strabismus with torticollis. *Arch. de Oft. de Buenos Aires*, 1942, v. 17, Aug., p. 439.

While the treatment of vertical strabismus with torticollis is essentially surgical, there is no agreement among ophthalmologists concerning the operation of choice. The most common cause of ocular torticollis in adults is paralysis of the superior oblique, while in children spasm of the inferior oblique is the most prevalent etiologic factor. The several operations which have been proposed for the correction of vertical strabismus are discussed in detail. In cases where the strabismus is due to spasm the author prefers

tenotomy of the muscle involved, while in paralysis he favors either transplantation of the vertical recti or advancement of the split oblique muscles. (Illustrations.) Plinio Montalván.

Burian, H. M. Motility clinic. Paresis of the right superior rectus muscle. *Amer. Jour. Ophth.*, 1944, v. 27, Aug., pp. 884-888. (2 tables, 2 diagrams.)

Crespi Jaume, Gonzalo. Unilateral ocular secretomotor syndrome. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1942, v. 1, Nov.-Dec., pp. 601-612. (See Section 12, Visual tracts and centers.)

Estrada, W. D. Sensory and motor ophthalmoplegia. *Rev. Brasileira de Oft.*, 1944, v. 2, March, pp. 135-146.

A white male, Portuguese, aged 46 years, came on account of diplopia which had made it necessary for him to cover the right eye with his hand in order to use the left eye. More recently, the right lid had drooped, and the patient found on raising the lid that he had lost more or less of the vision of this eye. The eye was amaurotic, and there was paralysis of the extrinsic and intrinsic muscles, with ptosis, anesthesia of the cornea, preservation of sensibility in the area of distribution of the lacrimal, and discrete dysesthesia and neuralgia in the area of the frontal. There was moderate exophthalmos, but the eyeball was freely movable. The light reflex, direct or consensual, was absent, and so was the accommodative reflex. The fundus appeared normal. The left eye was normal. General examination showed disease of the aorta, and painful crises in the two lower thirds of the right hemithorax. The patient also suffered from headache and occasional vomiting. The pulse and temperature were normal. The Wassermann reaction



proved negative as to both blood and spinal fluid. However, antiluetic treatment was initiated. X-ray examination showed changes in the sphenoidal fissure and the optic canal. X ray of the thorax showed general nodular changes, probably of a neoplastic nature. Two months after the patient's admission to the clinic, a small nodule was found beneath the right clavicle, and swollen areas were found in several ribs. Pathologic study of the infraclavicular nodule gave a diagnosis of lymphoepithelioma of the kind included by some modern authors in the group of reticulosarcomas. The patient died three months after admission, and autopsy disclosed the existence of a neoplasm at the level of the sphenoidal fissure and extending along the frontal and sphenoidal bones to the middle fossa of the cranium. (4 photographs, 2 photomicrographs, references.)

W. H. Crisp.

Gifford, S. R. **The treatment of concomitant strabismus.** Nebraska State Med. Jour., 1944, v. 29, May, p. 136.

The treatment of squint must begin as early as possible. The diagnosis can be made and treatment can be instituted at the age of one year. In convergent strabismus full correction found under cycloplegia is given and the amblyopic eye is trained by occlusion. If the child is too young to have his vision recorded, the eye with constant monocular squint is considered amblyopic. A check of vision is made after two weeks, and if the vision has improved the periods of occlusion can be shortened. In cases of alternating strabismus, occlusion is necessary to break up fusion and either eye is alternately covered. If, however, the eyes do not become straight, orthoptic

training must be instituted. If this is not available or is unsuccessful, surgery is indicated. For divergence strabismus, orthoptic exercises and occlusion are the only therapeutic measures possible before operation. Since recession of the externus and advancement of the internus produce a weaker effect than when performed on the opposite muscles, divergent squint requires a surgical procedure such as would be planned to correct a convergent squint of 50 percent greater amount.

R. Grunfeld.

Langdon, H. M., Ellis, V. M., and Mulberger, R. D. **Operative treatment of paralysis of the external rectus muscle.** Arch. of Ophth., 1944, v. 31, March, pp. 254-255.

The authors give a review of the literature as to procedures used by various writers. Most of the surgeons have in some way transplanted portions of the superior and inferior recti. In one case with successful result reported by Payne, marked improvement followed recession of the medial rectus and resection of the lateral rectus without any transplantation procedure.

The authors report two cases in which they did a recession of the medial rectus, advancement of the lateral rectus, and transplantation of the outer third of the superior and of the inferior rectus muscles with attachment to the old insertion of the lateral rectus muscle. (References.) R. W. Danielson.

Latorre Morasso, S. **Atypical deviation of the head in a case of oculomotor paralysis.** Arch. de la Soc. Oft. Hisp.-Amer., 1942, v. 1, Nov.-Dec., pp. 621-624.

Case report of paralysis of the right external rectus, in which the patient, instead of rotating the head along a

vertical axis to overcome the diplopia caused by absence of abduction to the right, bent the head forward, because in this position he seemed better able to overcome the diplopia. The author concludes that the position of the head is not always an accurate sign for making diagnosis as to a paralytic muscle. (2 photographs.)

Ramón Castroviejo.

Latorre Morasso, S., and Aguilar, J. Axenfeld-Schurenberg disease. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1942, v. 1. Nov.-Dec., pp. 625-631.

The author gives case reports of the syndrome first described by Axenfeld and Schurenberg in 1901, under the name of congenital cyclic oculomotor paralysis. In this condition, the muscles innervated by the third nerve manifest phases of paralysis alternating with spasm. The author reports two cases, with a similar picture of typical paralysis of the left third nerve. In both cases there was ptosis of the left upper lid, and in both cases the eyes were in abduction and the pupil was fixed. Alternating with this picture of paralysis, there were periods of spasm of the muscles innervated by the third nerve, during which the lid was raised and the pupil contracted, and the eye deviated inward or outward. In the first case the symptoms were noticed by the parents of the patient at the age of ten months; in the second case, at the age of fourteen months, after a fall. The pathogenesis of the condition is briefly discussed. (2 photographs, references.)

Ramón Castroviejo.

Lippmann, Otto. Paralysis of divergence due to cerebellar tumor. *Arch. of Ophth.*, 1944, v. 31, April, pp. 299-301.

Present knowledge of the mecha-

nism and of the subcortical center for divergence is incomplete. The majority of authors have assumed the existence of a center for divergence, probably located in the metencephalon in the vicinity of the abducens nucleus. There has been only one case of paralysis of divergence with autopsy report recorded. In this case the authors claimed a center for divergence in the mesencephalon near the nucleus of the oculomotor nerve.

The author reports the case of a male college student aged twenty years. During a period of observation of two years, the chief symptom had been paralysis of divergence. A diagnosis of cerebellar tumor was made and an operation performed. Direct inspection during operation proved that the lesion was a tumor of the vermis, extending downward along the medulla. Pressure from the tumor impeded the circulation of cerebrospinal fluid. The paralysis of divergence was most likely caused by pressure on the subcortical center of divergence. In this case, pressure could have been exerted only on the metencephalon and the findings tend to support the theory of a center for divergence in the vicinity of the nucleus of the sixth cranial nerve. The patient failed to recover from the incomplete removal of the tumor. (References.)

John C. Long.

Luz, Barbosa da. Concerning strabismus. *Rev. Brasileira de Oft.*, 1944, v. 2, March, pp. 147-152.

The author asserts that the motive in 95 percent of the cases of strabismus which come for treatment is cosmetic. He reviews briefly the steps to be taken in selecting cases for various forms of treatment. (References.)

W. H. Crisp.

Marin Amat, M. Ophthalmoplegic headache, or recurrent painful paralysis of the ocular muscles. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1942, v. 1, Nov.-Dec., pp. 593-600.

Case report of an intracranial tumor, located near the cavernous sinus, on the right side. The first symptoms to appear were severe right hemicrania, Bernard-Horner syndrome, and paralysis of the sixth nerve and of the first and second branches of the trigeminus. Within a year, the second, third, fourth, seventh, and eighth nerves were also affected. The presence of the tumor was confirmed by X ray. The author believes that the syndrome of the external wall of the cavernous sinus and so-called ophthalmoplegic headache are the same affection, the former more localized, the latter more extensive. The affection is of fatal prognosis, unless diagnosis is made in the early stages of the disease. (References.) Ramón Castroviejo.

Moreu, Angel. About a case of complete ophthalmoplegia associated with paralysis of several cranial nerves, caused by a tumor in the medial cerebral fossa. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1942, v. 1, Nov.-Dec., pp. 613-620.

Case report of complete ophthalmoplegia of the right eye, associated with paralysis of the first, fifth, seventh, eighth, ninth, and twelfth nerves. X ray revealed a tumor in the right medial cerebral fossa. The author discusses briefly the pathogenesis of the condition. (6 figures.)

Ramón Castroviejo.

Pugh, Mary. Orthoptic treatment. *The Practitioner*, 1944, v. 152, Feb., pp. 88-93.

Approximately one half of the cases

of squint are due to errors of refraction and are relieved by correction of such errors at the earliest possible age. Squint is seldom cured spontaneously. Psychologic trauma is causative in 10 to 20 percent. Here, in addition to proper correcting lenses, control of psychologic difficulties such as jealousy and imitation plays a more or less important role in keeping the eyes straight. The remaining 30 percent of cases of squint are due to defects in strength of the ocular muscles with or without the other two factors. The first stage of orthoptic training, which should commence at the earliest possible age, is sight development in the poorer eye by monocular occlusion, which should be observed monthly lest the poorer eye become the dominant eye. Good results after eight years of age are the exception. The usual standard for beginning the second step, the development of binocular vision, is 6/18 in the worse eye. The number of patients who recover normality by orthoptic treatment alone is approximately 10 to 15 percent. Surgery alone is successful in approximately 50 percent. Proper use of correcting glasses, orthoptic training, and surgery combined, however, gives successful results in 80 to 90 percent. Charles A. Bahn.

White, J. W. The choice of the fixating eye in paralytic and nonparalytic strabismus. *Amer. Jour. Ophth.*, 1944, v. 27, Aug., pp. 817-819; also *Trans. Amer. Ophth. Soc.*, 1943, v. 41, p. 319.

## 5

### CONJUNCTIVA

Allen, T. D. Epidemic keratoconjunctivitis from a subjective viewpoint. *Ophth. Ibero Amer.*, 1943, v. 5, no. 3, p. 206. (See *Amer. Jour. Ophth.*, 1944, v. 27, Jan., p. 16.)

Allen, J. H. Inclusion blennorrhoea. *Amer. Jour. Ophth.*, 1944, v. 27, Aug., pp. 833-846; also *Trans. Amer. Ophth. Soc.*, 1943, v. 41, p. 345. (One figure, 7 tables, references.)

Berens, C., and Nilson, E. L. Relationship between the bacteriology of the conjunctiva and nasal mucosa. *Amer. Jour. Ophth.*, 1944, v. 27, July, pp. 747-761; also *Trans. Amer. Ophth. Soc.*, 1943, v. 41, p. 109. (4 tables, extensive bibliography.)

Giqueaux, R. E., and Ochoa, R. G. Gonococcal conjunctivitis treated with Dagenan. *Anales Argentinos Oft.*, 1943, v. 4, July-Aug.-Sept., pp. 101-105.

The authors list four cases of severe gonorrheal conjunctivitis treated with Dagenan (a sulfonamide). The results were highly gratifying in that there was definite easing of symptoms in from 24 to 48 hours, while in from three to six days the diplococci disappeared from the conjunctival secretion. There were no untoward reactions to the drug, which was administered systemically. Edward Saskin.

Korns, R. F., Sanders, M., and Alexander, R. C. Epidemic keratoconjunctivitis. (Correlation of epidemiologic data and results of serum virus neutralization tests.) *Amer. Jour. Public Health*, etc., 1944, v. 34, June, p. 567.

The injection into mice of conjunctival scrapings from patients suffering from clinically diagnosed epidemic keratoconjunctivitis has not produced a transmissible agent. The mice invariably recovered, but the injection afforded the mice protection against the action of a virus previously isolated by Sanders, proving thus that the Sanders virus is etiologically re-

lated to epidemic keratoconjunctivitis. While one hundred control mice died from injection of virus in a dilution of  $10^{-3}$ , an equal number of inoculated mice succumbed only to a dilution of  $10^{-6}$ . Sera of convalescent patients gave evidence of the presence of antibodies, because some mice survived an injection of virus in a  $10^{-4}$  dilution of serum and others even a  $10^{-1}$  dilution. The last fact signifies that the serum contained 100,000 neutralizing doses. No neutralizing antibodies were present in the sera of patients during their first week of illness. Sera from healthy contacts, such as physicians and nurses, gave a high titer of antibodies although they never showed any clinical sign of epidemic keratoconjunctivitis. This fact proves the subclinical existence of this disease.

R. Grunfeld.

Lijó Pavía, J., Albertal, M., and Lachman, R. Infantile phlyctenular keratoconjunctivitis. *Rev. Oto-Neuro-Oft.*, 1944, v. 19, Jan.-Feb., pp. 9-22.

The authors generally accept the belief that true phlyctenular keratoconjunctivitis is part of a scrofulous syndrome. Phlyctenules occur in children with facial pallor, chronic coryza, adenoid hyperplasia, and so on; all cases show tracheobronchial and perihilar adenopathy; the tuberculin skin test is always positive; there is a daily elevation of temperature; there are frequently ear and mouth lesions; the family is usually tuberculin-positive.

By a colleague who used a similar approach in treating diphtheria, the authors were stimulated into trying an endonasal route for therapy, using a spray solution of tuberculin in strengths of 1 to 20,000 and 1 to 10,000. The advantages of this mode of therapy are: ease of application for

adult and child; little if any side-reaction to the tuberculin; number of necessary doses smaller than by the subcutaneous route; rapidity of absorption of tuberculin by the mucosa.

Observation of fifty children with established diagnoses of phlyctenular keratoconjunctivitis showed that thirty of the children were in the school-age group, while all but 12 had corneal ulcers associated with unilateral lung lesions, and those 12 had bilateral lung lesions. Of the thirty school children, twenty-three showed satisfactory improvement of the ocular process under this type of therapy.

Edward Saskin.

Lijó Pavia, J. *Trachoma and the local application of sulfonamides*. *Rev. Oto-Neuro-Oft.*, 1943, v. 18, Sept.-Oct., pp. 131-149.

This somewhat delayed paper adds to our fund of knowledge with respect to trachoma and the local use of the sulfonamides. The author points out, academically and clinically, that under this drug there is definite diminution in size of the trachomatous conjunctival nodule and regression of pannus. After discussing seven individual cases he describes a mode of treatment utilizing oral administration, local installation, and conjunctival spraying with the sulfonamide. The illustrations include excellent photographs of the conjunctiva as well as photomicrographs. The author concludes with the advice that conjunctival biopsies be made before and after treatment.

Edward Saskin.

MacCallan, A. F. *Some diseases of the eye met with abroad*. *The Practitioner*, 1944, v. 152, Feb., pp. 71-78.

A few of the commoner eye diseases

encountered in the tropics are outlined for the general physician by the author, whose experience in this field is probably greater than that of any living man. Snellen's operation is preferred in trachomatous entropion. The bacteria which most frequently cause conjunctivitis in the tropics are staphylococci, streptococci, Koch-Weeks bacillus, Morax-Axenfeld diplobacillus, pneumococci, gonococci, and diphtheria bacillus. All of these may produce an acute or chronic conjunctivitis, beginning as either type and changing to the other. When, in the more severe cases, specific treatment is impossible, the author recommends sulfonamides, 2-percent silver-nitrate applications to the everted lids daily, ointment to the lid margins to prevent gluing, and canthotomy if necessary. In mild conjunctival inflammations, the frequency of inverted lashes is emphasized. Trachoma is discussed at length. Not generally appreciated is the frequency of trachoma carriers who apparently have normal eyes but transmit the disease. In Egypt, the trachomatous infection is usually contaminated with Koch-Weeks bacillus, Morax-Axenfeld diplobacillus, gonococci, and other organisms. The author's well-known stages or types of trachoma and his mode of treatment are reviewed.

Charles A. Bahn.

Mangiaracine, A. B., and Pollen, A. *Meningococcic conjunctivitis*. *Arch. of Ophth.*, 1944, v. 31, April, pp. 284-288.

Within a five-month period the authors have observed in Boston ten cases of acute suppurative conjunctivitis of meningococcic origin. In none of these cases was there a definite history of exposure or general prodromal symptoms. Five of the patients gave a history of a "cold" at some period prior

to onset of the conjunctivitis. The ages varied from 14 weeks to 15 years, and all of the patients were males. One of the patients developed a frank meningitis and one a meningococcic septicemia with an abortive meningitis. In six cases the conjunctivitis was bilateral. Two of the patients developed superficial corneal ulcers and three showed corneal edema. Treatment consisted of local therapy with sulfanilamide solution and sulfathiazole ointment, combined in five cases with oral administration of the sulfonamides. Oral administration of the drug did not seem to hasten recovery. One case was treated by local instillation of a zinc-sulphate solution only. This patient improved as rapidly as did the others. The average length of hospitalization was eight days; the ocular discharge subsiding in three to five days, and the eyes becoming white and the process quiescent in seven days. In no case was there any permanent ocular damage. (References.) John C. Long.

Molner, J. G., and Cooper, E. L. Epidemic keratoconjunctivitis—Detroit experience. *Amer. Jour. Public Health*, etc., 1944, v. 34, June, p. 572.

Epidemic keratoconjunctivitis has been made a reportable disease in the State of Michigan. Physicians, nurses, and first-aid personnel have been familiarized with the clinical characteristics of the disease, its mode of spread, and so on. Since meticulous care and cleanliness are essential in controlling the spread of the disease, separate eye rooms have been established in the industrial plants. Strict adherence to communicable-disease technique has been introduced. The attendants are required to wear gowns and gloves and to scrub meticulously between cases. All contaminated eye-

room equipment is sterilized between individual cases. However, the authors find that the plan of separate eye rooms is contrary to good practice. Patients are excluded from work until the physician gives a permit to return.

Pontocaine, adrenalin chloride, and boric acid gave the best symptomatic relief. Five-percent sulfathiazole sesquihydrate was of no benefit. Covering the eye is contraindicated. A small absorbent pad fixed under the eyelid was comforting. A solution of tyrothricine, 30-mg. per 100 c.c., seemed to be valuable, and markedly reduced the incidence of complications. R. Grunfeld.

Penido Burnier and Lech, Jr. Treatment of trachoma. Reprint from *São Paulo Medico*, 1944, v. 23, Jan., pp. 23-44.

A general discussion of the subject, as presented before the First Inter-American Congress for Prevention of Blindness, July, 1942, Rio de Janeiro. (Bibliography.)

Shapland, C. D. A case of primary chancre of the bulbar conjunctiva. *Brit. Jour. Ophth.*, 1944, v. 28, April, pp. 187-189.

The patient, a male twenty years of age, reported for examination because of inflammation of the left eye of ten days duration, accompanied by slight discharge. There was edema of both lids of the left eye and of the plica semilunaris and caruncle. Swellings in the left parotid and submaxillary regions were noticeable, being due to enlargement of the lymphatic glands in those situations. An indurated area of cartilaginous consistence was palpable through the lower lid. When the lid was everted a small grayish-white ulcer was found, 4 mm. long and 1.5 mm.

broad, with sharply defined edges and gray sloughing base. The cornea was clear and showed no stain with fluorescein. A specimen of serum from the ulcer was positive to a dark field examination for *treponema pallidum*. Wassermann and Kahn reactions were both faintly positive.

Discharge from the left eye had ceased three days after treatment with arsenicals and bismuth were begun, and the ulcer had completely disappeared by the seventh day. The indurated band in the lower fornix remained unchanged for two weeks and then gradually retrogressed. Enlargement of the lymph glands disappeared gradually over the period of two months during which the patient was under observation and treatment. (One color plate, bibliography.)

Edna M. Reynolds.

Sorsby, A., and Hoffa, E. The sulfonamides in ophthalmia neonatorum. *Brit. Med. Jour.*, 1944, March 11, p. 353.

This paper presents a summary of the results of sulfonamide treatment of 258 cases of ophthalmia neonatorum, supplementing a similar earlier report on 273 cases. There was no striking difference in the results obtained with the various sulfonamides used—sulfapyridine, sulfathiazole, sulfamezathine, and sulfadiazine. Altogether, 29.9 percent were cured within 3 days, and 85.7 percent within 8 days. The drugs were efficacious in both gonorrheal and nongonorrheal ophthalmia, but quicker cures were obtained in the former group. Delay in initiating did not affect the success of the treatment. The medication was continued for three days after clinical cure was effected, and few relapses were observed. Benjamin Milder.

Sorsby, Arnold. Tuberculosis and the eye. *The Practitioner*, 1944, v. 152, Feb., pp. 79-81. (See Section 17, Systemic diseases and parasites.)

Theodore, F. H., and Kost, P. F. Meningococcic conjunctivitis. *Arch. of Ophth.*, 1944, v. 31, March, pp. 245-247.

The purpose of this paper is to call attention to the frequency of meningococcic conjunctivitis during periods in which the incidence of meningococcemia and of meningococcic meningitis is high, and to emphasize the importance of routine bacteriologic examination of the conjunctival discharge in all cases of acute catarrhal conjunctivitis.

Early recognition of meningococcic conjunctivitis is of great importance for two reasons: First, in cases in which the infection may go on to meningococcemia and meningitis, the great value of early administration of sulfonamide compounds is obvious. Second, even if the infection remains limited to the eye and responds to local treatment, it is of the greatest importance to prevent the patient's becoming a carrier.

Clinically, one cannot distinguish conjunctivitis due to the *Neisser* bacterium from other types of severe catarrhal conjunctivitis, although one may suspect it when the known incidence of this infection is high. The diagnosis therefore depends entirely on bacteriologic methods.

The authors give a detailed description of their culture technique, and report eight cases treated. They conclude by saying that the incidence of extrameningeal infection increases at times when meningococcic meningitis is prevalent. (References.)

R. W. Danielson.



Waldapfel, Richard. Infection of lymphoid tissue of the pharynx and of the conjunctiva. *Arch. of Ophth.*, 1944, v. 31, April, pp. 331-333.

The same kind of lymphoid tissue is found in the conjunctiva as is present in the pharynx. On the basis of the anatomic analogy between the lymphoid structures in the two areas, it is obvious to expect an analogy between the infections involving this tissue in the pharynx and conjunctiva respectively.

Two cases are reported in which "abscess-forming follicular conjunctivitis" was associated with follicular pharyngitis and mild systemic manifestations. Both cases responded promptly to internal administration of sulfadiazine and conjunctival application of sulfathiazole ointment.

The microscopic picture of this type of conjunctivitis is characterized by the occurrence of miliary abscesses in the lymph follicles of the conjunctiva, analogous to the abscesses in the lymph follicles of the pharynx associated with acute tonsillitis. According to the theory of Fein, tonsillitis is not a basic disease but is the secondary localization of an infection which has taken place elsewhere. The concurrence of this type of conjunctivitis with similar changes in the pharynx seems to support this view. (References.)

John C. Long.

## 6

### CORNEA AND SCLERA

Allen, T. D. Epidemic keratoconjunctivitis from a subjective viewpoint. *Ophth. Ibero Amer.*, 1943, v. 5, no. 3, p. 206. (See *Amer. Jour. Ophth.*, 1944, v. 27, Jan., p. 16.)

Campos, Evaldo. Treatment of ophthalmic herpes zoster with vita-

min C. *Rev. Brasileira de Oft.*, 1942, v. 2, March, pp. 157-163.

Typical herpes zoster in the area of distribution of the left ophthalmic nerve, in a boy of 11 years, showed great improvement the day after the second of two intravenous injections of the sodium salt of ascorbic acid, 0.1 gram each, on successive days.

W. H. Crisp.

Cogan, D. G., Hirsch, E. O., and Kinsey, V. E. The cornea. 6. Permeability characteristics of the excised cornea. *Arch. of Ophth.*, 1944, v. 31, May, pp. 408-412.

Leber's thesis that the epithelium and endothelium were impermeable to water since the corneal stroma did not appear to absorb tears or fluid from the aqueous had been widely accepted until recently. Coincidentally, these same membranes have been thought to be permeable to various dissolved substances, particularly those used in ophthalmic practice.

The technique of the authors' experiments is given in detail. Briefly, freshly excised beef corneas were tied on tubes epithelial side out, the tube immersed in a flask of water for an arbitrary period of 18 hours, and the results tabulated. The fluid in the tube was hypertonic to that in the flask by at least 0.2 mol of sodium chloride or its osmotic equivalent.

The authors observed that purely water-soluble substances did not pass through the epithelium (nor, in all probability, through the endothelium), while purely fat-soluble substances did not pass through the stroma. With the exception of water, substances which did get through the whole cornea had characteristically biphasic solubilities. Transfer of substances through the excised cornea did not differ appre-

ciably in the two directions. The conjunctiva showed qualitatively similar though less rigorous properties of permeability, and the sclera properties similar to those of the corneal stroma. (References and 4 tables.)

R. W. Danielson.

Ferguson, W. J. W. Ocular signs of riboflavin deficiency. *The Lancet*, 1944, v. 246, April 1, pp. 431-432.

Abnormal corneal vascularization of a clinically recognizable type and with very mild symptoms was found in 7.8 percent of 422 persons examined in Sheffield, England. These included industrial workers, students, and institutional inmates and outpatients. In 13 cases the use of riboflavin, especially in large doses approximating 15 mg. daily, was followed in three or four weeks by disappearance of the abnormal corneal vessels. Riboflavin deficiency is believed not to be the only cause of abnormal corneal vascularity. Vascular limbal engorgement is so frequent and so easily caused by so many physical and chemical factors that it is of little value in the diagnosis of vitamin deficiencies. Only such superficial new blood vessels as actually invade the cornea and involve the entire corneal circumference are to be considered as potential evidence of nutritional deficiency.

Charles A. Bahn.

Friedenwald, J. S., Hughes, W. F., Jr., and Herrmann, H. Acid-base tolerance of the cornea. *Arch. of Ophth.*, 1944, v. 31, April, pp. 279-283.

This experimental work was carried out as a preliminary to study of the mechanisms by which acids and alkalis damage the cornea. Living rabbit-corneas were treated with isotonic solutions of sodium hydroxide and hydro-

chloric acid of varying pH, combined with buffer agents. An elaborate system of grading the degree of reaction was devised, based on the intensity and duration of the corneal opacity, the degree of corneal edema, and the presence of corneal slough or ulceration, pannus, conjunctival reaction, and iritis. It was found that this system of grading gave very uniform results, even when carried out by different observers. The chemicals were applied by dropping the solution on the cornea after mechanical removal of the epithelium, and also by intrastromal injection of 0.1 c.c. of the substance.

The data obtained are charted graphically. It was demonstrated that the corneal epithelium served as a protection against the action of acids, but much less against that of alkalis. One of the first effects of application of an alkali is loss of the epithelium. The effect of intrastromal injection of unbuffered sodium hydroxide or hydrochloric acid was less than the effect of these same solutions when instilled. This difference is explained by the buffering effect of the corneal tissue. It was found possible to determine the pH tolerance of the cornea, but this tolerance is not wholly independent of the ionic species used. (2 illustrations, 6 graphs, references.)

John C. Long.

Knapp, A. A. Corneal graft or tattooing with iridectomy? *U. S. Naval Med. Bull.*, 1944, v. 42, June, p. 1366.

Corneal graft is never to be recommended. A corneal graft will remain transparent only if it is imbedded within a partially clear stromal area of the host's cornea. When there is a small but clear area of cornea in the interpalpebral fissure, tattooing followed by an optical iridectomy is the

operation of choice. In keratoconus high doses of vitamin D and calcium are indicated, but not a corneal graft. The author has performed corneal tattooing and iridectomy in six cases. The vision varied from 20/200 to 20/100 and improved after operation to 20/30 in four cases and 20/20 in two cases. Corneal tattooing may remain effective for at least seven years.

R. Grunfeld.

Korns, R. F., Sanders, M., and Alexander, R. C. Epidemic keratoconjunctivitis. (Correlation of epidemiologic data and results of serum virus neutralization tests.) Amer. Jour. Public Health, etc., 1944, v. 34, June, p. 567. (See Section 5, Conjunctiva.)

Lijó Pavía, J., Albertal, M., and Lachman, R. Infantile phlyctenular keratoconjunctivitis. Rev. Oto-Neuro-Oft., 1944, v. 19, Jan.-Feb., pp. 9-22. (See Section 5, Conjunctiva.)

Lyle, T. K. Corneal vascularization in nutritional deficiency. The Lancet, 1944, v. 246, March 25, pp. 393-395.

In the individual cornea, vascularity is not necessarily an evidence of dietary deficiency. Many individuals receiving excellent diets had corneal blood-vessels and many subjects with much corneal vascularity did not improve after the diet was supplemented. In groups, however, corneal vascularity is proportionate to general nutrition. Riboflavin is not the only nutrient involved in the prevention of corneal vascularization; in fact, it is a minor one compared with others present in fruits and vegetables. The above conclusions were formed after detailed study of 4,000 RAF personnel, one half stationed in Britain and the other half stationed in different parts of the British Empire. Only

those who had been stationed six months in any locality were used. Most of the subjects were between twenty and thirty years of age, and were examined at regular intervals with the biomicroscope. Climate had no effect on corneal vascularity. Only 0.5 percent of those examined had even slight photophobia when examined biomicroscopically. This usually accompanied corneal vascularity.

Charles A. Bahn.

Molner, J. G., and Cooper, E. L. Epidemic keratoconjunctivitis—Detroit experience. Amer. Jour. Public Health, etc., 1944, v. 34, June, p. 572. (See Section 5, Conjunctiva.)

Trevor-Roper, P. D. Treatment of hypopyon ulcers with albucid and proflavine. Brit. Jour. Ophth., 1944, v. 28, April, pp. 181-184.

Twelve cases of hypopyon ulcer treated with albucid, twelve cases treated with proflavine, and one with oral sulfapyridine; as well as three cases of hypopyon-iritis treated with proflavine irrigations, are reported.

In the cases treated with albucid, a 30-percent solution was instilled every hour during the day for four days and at night a 10-percent ointment was applied every four hours for four nights. This was followed by the use of a 10-percent ointment three times daily. In six of these cases, the hypopyon cleared in from three to nine days. In three cases the hypopyon was still present when the patients were transferred to a base hospital. In three cases, Saemisch section was required. Two of these eyes had to be eviscerated later.

The cases treated with proflavine had two hourly irrigations of 0.1-percent solution of proflavine in saline by

day and four hourly irrigations at night. Three of these cases required Saemisch sections, but the hypopyon cleared in from one to three days in the remaining cases. The three cases of hypopyon iritis cleared in from one to two days following the use of proflavine irrigations. (Proflavine is a recently introduced flavine derivative, said to be of great bactericidal power and of much lower toxicity than the other flavine antiseptics.)

Edna M. Reynolds.

Weskamp, Carlos. Bowen's disease of the cornea. *Arch. of Ophth.*, 1944, v. 31, April, pp. 310-315.

Bowen's disease of the skin is an extremely chronic and slowly progressive condition which has been called precancerous dermatosis. Histologically, the lesion has the appearance of an epithelioma composed of dyskeratotic cells which have not yet ruptured the basement membrane—"intraepithelial epithelioma." Some authors contend that the lesion is malignant from the beginning. If the condition exists sufficiently long, the basement membrane becomes broken and infiltration of the underlying tissues begins.

The author reports a case of Bowen's disease of the cornea in a man of 56 years. Each cornea presented patches of grayish, ground-glass appearance, formed by coalescence of numerous minute, rounded spots. On the surface of the lesions were small translucent protrusions of gelatinous tissue. Vascularization occurred near the limbus. As the lesions were superficial, it was possible to excise them totally, leaving clear cornea. Vision improved from ability to count fingers at 3 meters to 2/3. (Drawings, photomicrographs.)

John C. Long.

#### UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Correa Netto, Orozimbo. Considerations in regard to a case of complete albinism of the eyes. *Arquivos Brasileiros de Oft.*, 1944, v. 7, Feb., pp. 13-19. (See Section 13, Eyeball and orbit.)

Daniel, R. K. Healing of the iris in rabbits following experimental iridectomy. *Arch. of Ophth.*, 1944, v. 31, April, pp. 292-298.

The comparative anatomy of the iris in man and rabbit is discussed in some detail. Gross and microscopic observations were made of the healing processes in the rabbit eye following iridectomy. There was evidence that the iris has no tendency to regenerate itself. The iris showed only a feeble attempt to bridge the defect with a few scattered fibroblasts and epithelial or endothelial cells in a few eyes examined early after surgery. There was failure of the iris to permanently bridge the coloboma. The tissue and the cut surface of the iris remained unchanged. Frequent and prolific invasion of corneal fibroblasts into the approximated cut edges of the iris in the region of the wound was observed. This occurred in moderate degree even when healing of the incision was rapid and firm, when the iris was not caught in the wound itself, and when there was no evidence of infection or inflammation. (3 figures, references.)

John C. Long.

Hessberg, R. J. X-ray treatment of thrombosis of the retinal vein and of several types of iridocyclitis. *Amer. Jour. Ophth.*, 1944, v. 27, Aug., pp. 864-875. (2 tables, references.)

James, Theodore. A case of Adie's syndrome. *Brit. Jour. Ophth.*, 1944, v. 28, April, pp. 190-193.

The patient, a male aged 21 years, had no abnormality of the eyes whatever except that the right pupil was about two-thirds the size of the left. Examination of the nervous system disclosed the following abnormalities: absence of the right knee jerk and both ankle jerks. Both triceps jerks and the left knee jerk were normal. The Kahn reaction was negative. The right pupil remained consistently smaller than the left under atropine and eserine instillations, and after subcutaneous injections of strychnine sulphate.

The fact that complete dilatation of the right pupil did not follow atropine mydriasis suggests a hypotonic state of the dilator pupillae, so the author feels that it is reasonable to assume (1) that the relative smallness of the pupil was due to hypertonicity of the sphincter pupillae over the dilator or (2) that because the actual size of the pupil remained moderate there was an almost atonic nervous balance. To explain the syndrome, the author assumes that the delayed "tonic" pupillary reflexes of Adie are in reality "atonic" and due to generalized nervous asthenia. The degree of such asthenia might vary from time to time, with a corresponding effect upon the pupils, which are much more sensitive to such variations than are the tendon reflexes. The benign and nonsyphilitic nature of the syndrome in this patient is emphasized. (References.)

Edna M. Reynolds.

Van Poole, G. McD. Adie's syndrome. *Amer. Jour. Ophth.*, 1944, v. 27, July, pp. 762-763. (References.)

## 8

## GLAUCOMA AND OCULAR TENSION

Damel, C. S., and Arouh, J. Secondary glaucoma due to epithelial penetration. *Arch. de Oft. de Buenos Aires*, 1942, v. 17, Aug., p. 489.

A patient operated on for cataract developed iridocyclitis and secondary glaucoma as late postoperative complications, which eventually led to enucleation of the affected eye. Histo-pathologic examination revealed the presence of an epithelial ingrowth which lined the whole anterior surface of the iris, the pupillary interval and the angle of the anterior chamber. The literature on the subject is reviewed. The authors believe themselves the first to report this condition in Argentina. (Photomicrographs, bibliography.)  
Plinio Montalván.

Denig, Rudolf. Iridotorsion; iridec-tomy; cyclectomy. *Arch. of Ophth.*, 1944, v. 31, March, pp. 242-244.

This article gives a comparison of these procedures and a discussion of their interrelationship. Denig says that iridotorsion was evolved from the isolation procedure by retrograde deduction. When the iris is incised on one side only, it maintains vital connection with its trunk, while at the same time its length is doubled. The purpose of cutting only one iris pillar is not only to supply such an insurance against late infection, but primarily to permit free passage of intraocular fluid into the subconjunctival space. Accordingly, iridotorsion should aim at establishment of a perfect sclerectomy channel into which the sensitive iris wick, so easily rendered impermeable by pressure, is to be embedded. The success of the operation will depend primarily on meticulous execution of this step.

The author refers to his original article on this subject (Amer. Jour. Ophth., 1941, v. 24, p. 234), and in this paper elaborates on the important points of the technique. One case is reported. The conclusions are: (1) No great reliance can be placed on cyclodialysis; (2) It is advisable to perform cyclodialysis and iridotorsion at one sitting, provided the anterior chamber deepens immediately after cyclodialysis; (3) With a scleral spur as narrow as 1 mm., iridotorsion may be performed instead of Graefe's iridectomy, even in cases of acute glaucoma, and is more reliable. (References.)

R. W. Danielson.

Espíldora Luque, C., and Schweitzer, A. Postoperative results in chronic glaucoma. Arch. de Oft. de Buenos Aires, 1942, v. 17, Aug., p. 457.

Seventy-seven cases of chronic glaucoma of different types were operated upon after miotics had failed to keep the tension under control. Of the whole series, the results were good in 53.2 percent, fair in 24.6 percent, and poor in 22.2 percent. The operations performed and the percentages of good results obtained with each of them were as follows: iridencleisis 63.6 percent, trephining 46.6 percent, modified Lagrange 52.6 percent, and cyclodialysis 54.5 percent. According to the type, the results in chronic simple glaucoma were good in 52 percent and poor in 22 percent, while in inflammatory glaucoma they were good in 55 percent and poor in 22 percent.

Plinio Montalván.

Evans, J. N. Modifications of the tonometer. Arch. of Ophth., 1944, v. 31, April, pp. 334-335.

Two modifications of the Schiötz tonometer are described. In the first

modification, an ophthalmoscope bulb is attached to the finger grip of the instrument so that it shines on a weak plus lens on the tip of the pointer and on a similar lens attached to the scales of the instrument. By means of this arrangement two beams of light are projected on to a scale on the ceiling, so that fluctuations in the tonometer arm can be read greatly magnified.

The second modification replaces the pointer with a beam of light. An ophthalmoscope bulb is attached to the finger grip. This light shines on a prism-lens combination mounted on the rod, its optical system being so arranged that a beam of light is projected on the regular scale of the tonometer. Fluctuations in the rod are thus transmitted by the light beam to the scale. This arrangement eliminates the pointer, its pivot, and the sliding cam against which the tonometer rod operates, leaving only one moving part. In each instrument a small battery attached to the examiner's wrist by a clip supplies the current through a flexible cable. (2 figures.)

John C. Long.

Iliff, C. E. Surgical control of glaucoma in the Negro. Amer. Jour. Ophth., 1944, v. 27, July, pp. 731-738. (12 tables, references.)

Lowenstein, O., and Schoenberg, M. J. Nervous factor in the origin of simple glaucoma. Arch. of Ophth., 1944, v. 31, May, pp. 384-391.

Lowenstein and Schoenberg have stated in a previous paper that, in cases of clinically unilateral simple glaucoma, pupillary disturbances are generally found in the seemingly unaffected eye. These disturbances were found to be based on three factors: modification of the retinal receptors,

damage to the effector organs, and lesions in the central nervous system. While in the early stage of the disease the first two factors were not constant, the third was. The authors, on the basis of new experiments, discuss in the present paper the origin and significance of the nervous factor. Four groups of cases were distinguished and a representative case from each is described.

The conclusions are as follows: (1) In all cases of primary simple glaucoma studied, constant characteristics of the pupillary reflex to light were shown by both eyes. (2) In all cases of the initial stage of the disease, the pathologic feature in the reflex to light was disproportion between the primary phase of contraction and the secondary and tertiary phases, the former being more or less preserved and the latter being decreased or absent. (3) In cases of advanced simple glaucoma, and frequently also in cases of the initial stage, additional modifications were found, while the primary stage of contraction was sluggish and less extensive and was preceded by a longer latency period. (4) In cases of unilateral simple glaucoma the clinically unaffected eye showed pupillographic features characteristic of simple glaucoma. In some of the cases the pupillary disturbances were of purely central sympathetic origin; in others the sympathetic type was modified by ocular factors. (5) The occurrence of characteristic pupillary disturbances in the clinically unaffected eye points to the presence of latent glaucoma in that eye. (6) Intraocular hypertension is only one symptom in a syndrome in which ocular hypertension, lesions of the receptor and effector organs within the eye, and other signs exist as equivalent expressions

of the same central lesion. (7) Although lesions of the central nervous system appear to be an important factor in the genesis of simple glaucoma, it is not certain whether such lesions, although organic, are primary or are secondary to other etiologic factors, such as nutritional deficiency and toxicosis. (References, 7 tables.)

R. W. Danielson.

Lowenstein, O., and Schoenberg, M. J. Pupillary reactions of the seemingly unaffected eye in clinically unilateral simple glaucoma. *Arch. of Ophth.*, 1944, v. 31, May, pp. 392-398.

Whether the cause of simple glaucoma lies within the eye itself or in disturbances outside the eye, or both, is still a question. The authors have investigated the problem of whether the disturbances of pupillary reaction, which so far have been present in all cases of glaucoma observed, are of central origin or originate in secondary modifications of the receptor or effector organs in the eye.

In every case of unilateral simple glaucoma studied, pupillary disturbances were also evident, although to a lesser extent, in the unaffected eye. Functional modifications of either the retina or the optic nerve or both were frequently but not always present. These findings appear to promise a new way of establishing a diagnosis of glaucoma simplex in a preclinical stage. Six detailed case histories are included in this report. (7 graphs.)

R. W. Danielson.

Von Grolman, G., and Angel, E. Contribution to the study of drugs that influence the circulation and intraocular pressure. *Arch. de Oft. de Buenos Aires*, 1942, v. 17, Aug., p. 466.

The authors studied clinically the



action of certain drugs upon ocular circulation and tension. Nicotinic acid is a potent cephalic vasodilator and hypotensor. Acetylcholine is ineffective when given subcutaneously or intramuscularly, but in retrobulbar injection it is a powerful vasodilator and hypertensor of the central retinal artery. Given subconjunctivally it is a potent miotic and ocular hypotensor. The hypotensive action of mecholyl is less constant but more lasting than that of acetylcholine; while doryl is more intense and stable. Eupaverin and adenosynphosphoric or adenilic acid were not used in sufficient dosage to record any appreciable action. (Tables, data.)

Plinio Montalván.

# 9

## CRYSTALLINE LENS

Davis, F. A. Catgut sutures for closure of the deep corneoscleral wound in operations for cataract. *Arch. of Ophth.*, 1944, v. 31, April, pp. 321-322.

The author has modified the cataract incision as follows: A Graefe section is made in such a manner that there is a definite conjunctival flap at all points. One or two sutures of 00000 plain catgut are inserted between the corneal lip and the sclera. After delivery of the lens, the sutures are tied with two knots and the ends cut short. The conjunctiva is then closed with silk sutures. This produces tight closure of the wound. In seventy cases so treated there were no serious complications attributable to this method of suturing. In some cases there was temporary swelling of the conjunctival flap over the buried sutures, but this was entirely absent in most instances. The eyes showed no more reaction than is usually seen with cataract extractions. Chromic catgut has not been

so satisfactory as the plain; because it takes too long for absorption, and at times the conjunctiva has become eroded over the knots.

John C. Long.

Davis, F. A. Intracapsular cataract extraction. *Arch. of Ophth.*, 1944, v. 31, May, pp. 367-375.

In this report the author submits a statistical analysis of five hundred consecutive cases of intracapsular extraction performed by himself and his associates on the staff of the University of Wisconsin General Hospital.

The age range of the cases, grouped according to decades, was from thirty to ninety years. The author preferred and generally used extraction combined with complete or peripheral iridectomy. On some of the younger subjects, with healthy, active irises, for whom a perfect cosmetic result was desirable, simple extraction with peripheral buttonhole iridectomy was employed. Intracapsular extraction in younger subjects, under forty years of age, is usually not successful (especially when the cataract is immature and partly clear or is of the congenital or juvenile type) since the zonule is tough and elastic and will not rupture easily. Davis feels the intracapsular procedure should be avoided in older, feeble and uncoöperative patients.

Prolapse of the vitreous, hemorrhage into the anterior chamber and resulting visual acuity are discussed at length. The author concludes by saying that once the intracapsular cataract extraction technique is acquired, the operation is easier than the older method of capsulotomy, at least he finds it so. Loss of vitreous is no more frequently encountered, and need be no more common, than in the extracapsular operation. Healing in the ma-

jority of cases is far more rapid and attended with fewer complications. (References, 13 tables.)

R. W. Danielson.

Kirby, D. B. Further experiences with a system of intracapsular extraction of cataract. *Arch. of Ophth.*, 1944, v. 31, April, pp. 302-309; also *Trans. Amer. Ophth. Soc.*, 1943, v. 41, p. 61.

The author has developed an orderly series of techniques to be applied to different conditions encountered during cataract operations. The fragility of the zonule has much to do with the type of effort applied to an intracapsular extraction. In approximately 15 percent of cases the zonule is very fragile, permitting delivery of the lens by traction or pressure alone. Seventy percent of cataractous eyes have zonules of average resistance which require pressure plus traction and rotation. The remaining 15 percent have zonules of considerable resistance, requiring, in addition to traction and pressure, the stripping of the zonule from the upper third of the equator of the lens.

The author uses a suture in the corneal flap to retract or elevate the flap in order to obtain a clear view of the iris and lens capsule. In general, a peripheral iridotomy is done if the pupil will dilate to 6 mm. or more. Technical details are given for the method of removing the lens for each class of zonule encountered. The method of zonular stripping is stated in detail.

Results obtained and observations made during one hundred consecutive cataract extractions are tabulated. Loss of vitreous, inflammation, glaucoma, detachment of choroid and retina, and astigmatism as complications are discussed. In this series, vision of

20/30 or better was obtained in 86 percent of the cases, and vision less than 20/200 was obtained in only 4 percent.

John C. Long.

Nelson, F. Almost complete retinal detachment after cataract extraction; complete reattachment after glaucoma attack. *Amer. Jour. Ophth.*, 1944, v. 27, Aug., pp. 876-883. (One figure, references.)

Semeraro, Edmundo. Postoperative care of cataract patients. *Rev. Brasileira de Oft.*, 1944, v. 2, June, pp. 203-207.

This brief article particularly opposes synchronous resort to eserine and to keeping the patient in darkness, since one tends to contract the pupil while the other tends to dilate it.

W. H. Crisp.

Stern, H. J. Report on two pairs of brothers showing Marfan's syndrome. *Brit. Jour. Ophth.*, 1944, v. 28, May, pp. 229-232.

One pair were unusually small in stature, the other pair abnormally large. All four showed pathologic structure of the bones—seen for the first time in cases of Marfan's syndrome but known to occur in cases of endocrine dysfunction. All showed an abnormally small sella turcica. (References.)

Edna M. Reynolds.

## 10

### RETINA AND VITREOUS

Butler, T. H. A case of angioid streaks of the retina. *Brit. Jour. Ophth.*, 1944, v. 28, May, pp. 220-224.

A case of angioid streaks of the retina which developed within an interval of two weeks is reported. There were also a diffuse bilateral choroiditis and an exudate in the right macular

region. Angioid streaks are explained as probably due to folding of the retina, with a deposit of pigmentary debris between the layer of rods and cones and the pigment layer, rather than to a slow pathologic process such as the formation of new vessels. (2 illustrations.) Edna M. Reynolds.

Cordes, F. C. A type of foveo-macular retinitis observed in the U. S. Navy. *Amer. Jour. Ophth.*, 1944, v. 27, Aug., pp. 803-816. (3 photomicrographs, references.)

Elwyn, Herman. Changes in the fundus of the eye in various forms of arterial hypertension. *Arch. of Ophth.*, 1944, v. 31, May, pp. 376-382.

The author discusses in detail the changes appearing in the fundus in the various forms of hypertension. He says these changes depend on contraction of the retinal arteries, and on the degree and extent of their aging and sclerosis.

Depending on the persistence of the arterial contraction, the changes in the retina can be separated into acute arteriospastic retinitis, or retinopathy, characterized by edema, "cotton-wool" patches, and hemorrhages; and a more chronic arteriospastic retinitis, or retinopathy, characterized by deposits of hyalin and lipids and by the star-shaped figure in the macular area.

In uncomplicated essential hypertension in its benign form the retinal arteries are not contracted. The changes in the fundus of the eye are only those of aging and sclerosis of the retinal vessels. In the later stages occur complications such as hemorrhages, white spots, occlusion of branches of the central vein and artery, and occasionally also of the main vessels. A more important condition is temporary arterio-

spastic retinitis, as part of a temporary arterial contraction in many organs. The clinical picture may be differentiated from that of the malignant stage of essential hypertension by the absence of any severe renal insufficiency. In other forms of hypertension the fundus presents varying combinations of the signs of acute and chronic arteriospastic retinitis and of aging and sclerosis of the retinal vessels. (Discussion, references.)

R. W. Danielson.

Gifford, S. R. The eye in general diagnosis. *Wisconsin Med. Jour.*, 1944, v. 43, May, p. 509.

The author classifies the vascular fundus changes into five groups. (1) Retinal arteriosclerosis: slight indentation of some veins by arteries, slight caliber changes of arteries, no hemorrhages or white deposits. Clinically the case appears as benign hypertension; the diastolic pressure is rarely above 110, the systolic pressure is moderately increased.

(2) Retinal arteriosclerosis with retinopathy: The arterial changes described above are more advanced. In addition some patchy hemorrhages and white deposits are found, occasionally thrombosis of veins or arteries. The prognosis is still good.

(3) Diffuse retinal arteriolar constriction: All arteries show definite contraction. The calibers of the arteries and veins have a ratio of 1 : 2. No hemorrhages or deposits are found. Indentation of veins may be present or absent. The blood pressure, especially the diastolic pressure, is high. Typical are early cases of toxemia of pregnancy.

(4) Diffuse retinal arteriolar constriction with retinopathy. Hypertensive retinopathy. The vascular contrac-

tion is more pronounced. The ratio of arteries to veins is 1 : 4. Hemorrhages, "cotton-wool" deposits, and localized areas of retinal ischemia and edema are commonly found. Clinically the case appears as a well-developed case of essential hypertension. The diastolic pressure is constantly above 130. The prognosis is bad except as to the toxemia of pregnancy. Most patients die within four or five years.

(5) Diffuse retinal arteriolar constriction with neuroretinopathy: malignant hypertension. In addition to the findings in the last group, edema of the optic nerve and surrounding retina appear. Macular star is a frequent, detachment of retina a rare, accompaniment. Prognosis very grave. Eighty percent of the patients die within one year.

In central angiopathic retinopathy there is sudden loss of vision, mostly in one eye. There are no changes in the retinal arterioles, but definite edema of the macular region, often surrounded by a circular reflex probably due to elevation of the retina by edema, is observed. The loss of vision is caused by spasm of the capillaries or precapillaries supplying the macula. Frequently it clears under antispasmodic therapy.

Some cases of periphlebitis retinae, or recurring vitreous hemorrhages in the young, are probably due to angiospasm, for several such patients have responded well to antispasmodic therapy. R. Grunfeld.

Hessberg, R. J. X-ray treatment of thrombosis of the retinal vein and of several types of iridocyclitis. *Amer. Jour. Ophth.*, 1944, v. 27, Aug., pp. 864-875. (2 tables, references.)

Lijó Pavía, J., and Lachman, R. Green spots in the fundus. *Rev. Oto-*

*Neuro-Oft.*, 1943, v. 18, Nov., pp. 171-179.

Green spotting of the fundus, the authors feel, is much more frequent than is generally supposed. They have already observed 47 cases of the condition, this communication dealing with the last three. The green area is best seen with red-free light and must be differentiated from pigment accumulation, choroidal hemorrhage, and intervascular pigment. The characteristic details of the green area are: (1) The borders are hazy and fade out gradually. (2) The green area is definitely discrete. (3) The central portion may not have the same clarity of color throughout. Several excellent retinographs portray the green spots in the three cases presented by the authors. The actual genesis of these unusual areas of the fundus is not discussed. Vision is usually reduced. (4 illustrations, references.)

Edward Saskin.

Nelson, F. Almost complete retinal detachment after cataract extraction; complete reattachment after glaucoma attack. *Amer. Jour. Ophth.*, 1944, v. 27, Aug., pp. 876-883. (One figure, references.)

Rucker, C. W. Sheathing of the retinal veins in multiple sclerosis. *Proc. Staff Meetings Mayo Clinic*, 1944, v. 19, April 5, p. 176.

The author has collected laboratory and clinical data on 34 patients in whose retinas he found varying degrees of sheathing of the retinal veins, with no other retinal vascular changes. There was occasional simple optic atrophy. Of the 34 cases, 21 had been diagnosed as having multiple sclerosis; and 7 more were suspects. In 12 of the cases, there was pallor of one or both

optic discs. Eight of the patients had a history of retrobulbar neuritis. No explanation of the structure of the perivenous sheath is offered.

Benjamin Milder.

Shapland, C. D. A case of rupture of a retinal cyst causing retinal detachment. *Brit. Jour. Ophth.*, 1944, v. 28, May, pp. 236-241.

The case presented shows conclusively that disinsertion of the retina can be produced by rupture of a retinal cyst. The periphery of the cyst above and below was delimited by a linear band of pigmentation. Operation was successful, with recovery of central vision of 6/24 and the field full except for defects corresponding to the remains of the cyst and to the diathermy reactions. (4 figures, references.)

Edna M. Reynolds.

Treusch, J. V., and Rucker, C. W. Incidence of changes of retinal veins in multiple sclerosis. *Proc. Staff Meetings Mayo Clinic*, 1944, v. 19, May 17, p. 253.

The authors examined the fundi of 52 patients who had multiple sclerosis. Ten showed perivenous sheathing. It occurred independently of previous visual complaint and was not related to the occurrence of pallor of the optic disc. In not a single instance was perivenous sheathing found in one hundred patients with no neuralgic complaint. The perivenous sheathing which we encounter in uveitis, optic neuritis, or phlebitis, or in diabetic or hypertensive retinitis, or in degenerative retinal changes is readily explainable by the underlying disease. But in multiple sclerosis we find no retinopathy with the exception of the occasionally present simple optic atrophy.

R. Grunfeld.

Vilela, A. Etiopathogenesis of the arterial hypertension called "essential"—present status of the problem. *Rev. Brasileira de Oft.*, 1944, v. 2, June, pp. 181-191.

This is a general review of the subject, with reference to certain writers including Wagener.

## 11

### OPTIC NERVE AND TOXIC AMBLYOPIAS

Carroll, F. D. The etiology and treatment of tobacco-alcohol amblyopia. *Amer. Jour. Ophth.*, 1944, v. 27, July, pp. 713-725; Aug., pp. 847-863; also *Trans. Amer. Ophth. Soc.*, 1943, v. 41, p. 385. (5 tables, 21 figures, references.)

Cordes, F. C., and S. D. Aiken. Papilledema (choked disc) and papillitis (optic neuritis); their differential diagnosis. *Jour. Nervous and Mental Dis.*, 1944, v. 99, May, p. 576.

The authors describe the causes, symptoms, appearance, and pathology of papilledema and papillitis. The former is seen in 80 percent of brain tumors, but will occur in any situation which disturbs the pressure relationships of the circulation on either side of the lamina cribrosa. Thus, sudden lowering of the intraocular pressure may be followed by papilledema. The early ophthalmoscopic evidences and the typical appearance of the disc in papilledema are described. The swelling of the disc may recede without leaving a trace, or some optic atrophy may appear secondarily. The characteristic visual field finding is an enlargement of the blind spot. There is an anterior bowing of the lamina cribrosa.

In papillitis, however, there is marked cellular inflammatory reaction,

usually perivascular, and no anterior bowing of the lamina cribrosa. Clinically, optic neuritis is usually unilateral, without marked elevation of the disc (ordinarily not more than 2 D.), and is ushered in by sudden loss of central vision. There is a marked tendency toward recovery of function. The chief points in differential diagnosis are that in papillitis we find sudden loss of central vision, with central scotoma, and a less marked ophthalmoscopic picture. Benjamin Milder.

Cotlier, I. Bilateral coloboma of the entrance of the optic nerve. *Anales Argentinos Oft.*, 1943, v. 4, July-Aug.-Sept., pp. 97-100.

The author admits the rarity of this developmental anomaly and offers certain diagnostic characteristics: (1) apparent enlargement of the diameter of the papilla; (2) total or partial excavation of the disc, a true ectasia; (3) deep and superficial whiteness of the disc; (4) the special disposition of the vessels, arising inferiorly, centrally, or peripherally relative to the disc. The

case of a four-year-old female is recorded, with bilateral disc-coloboma more marked in one eye, but neither eye showing great visual impairment.

Edward Saskin.

Lijó Pavia, J. Coloboma of the papilla. *Rev. Oto-Neuro-Oft.*, 1943, v. 18, Dec., pp. 203-222.

The author describes the typical papillary coloboma as situated inferiorly, usually the only ocular defect present, sometimes bilateral, and simulating a greatly enlarged disc. Many excellent simple and panoramic retinographs and chromo-retinographs illustrate the author's eight cases. His synopsis reveals that the cases ranged in age from six to 51 years, included six females to two males, and had papillas ranging from  $1\frac{1}{2}$  to  $9\frac{1}{2}$  normal disc diameters. Disc excavation varied from 3 to 12 diopters, and vision in some cases was reduced to as little as counting fingers, and in others was hardly reduced at all. (15 illustrations, including one color plate; references.)

Edward Saskin.

## NEWS ITEMS

Edited by DR. DONALD J. LYLE  
904 Carew Tower, Cincinnati 2

News items should reach the editor by the twelfth of the month

### DEATHS

Dr. Ellsworth F. Arble, Carrolltown, Pennsylvania, died July 5, 1944, aged 71 years.

Dr. Charles H. Baker, Bay City, Michigan, died July 7, 1944, aged 84 years.

Dr. Pierre Bergeron, Manchester, New Hampshire, died May 7, 1944, aged 62 years.

Dr. William J. Blackburn, Dayton, Ohio, died July 16, 1944, aged 75 years.

Dr. Oliver P. Bourbon, Los Angeles, California, died April 25, 1944, aged 80 years.

Dr. Arthur M. Brianza, Chicago, Illinois, died July 11, 1944, aged 76 years.

Dr. Ralph O. Early, Oklahoma City, Oklahoma, died June 6, 1944, aged 64 years.

Dr. William A. Fisher, Chicago, Illinois, died July 31, 1944, aged 84 years.

Dr. Abraham C. Green, Chicago, Illinois, died June 7, 1944, aged 57 years.

Dr. Robert P. Hooper, Kosciusko, Mississippi, died May 20, 1944, aged 78 years.

Dr. Louis A. Julianelle, New York, New York, died August 12, 1944, aged 49 years.

Dr. John C. Kamp, Saugerties, New York, died June 18, 1944, aged 84 years.

Dr. Harry W. Long, Escanaba, Michigan, died May 30, 1944, aged 65 years.

Dr. C. W. Naar, Paramaribo, Surinam, died recently.

Dr. Bert E. Purcell, Iowa Falls, Iowa, died May 15, 1944, aged 68 years.

Dr. Clarence W. Robertson, Jamestown, North Dakota, died May 22, 1944, aged 53 years.

Dr. William T. Salmon, Duncan, Oklahoma, died June 26, 1944, aged 75 years.

Dr. Horace W. Sherwood, Doland, South Dakota, died August 5, 1944, aged 78 years.

Dr. Edwin J. Siegmund, Wabash, Indiana, died May 25, 1944, aged 68 years.

Dr. Harry B. Weinburgh, Lansing, Michigan, died June 29, 1944, aged 62 years.

Dr. Myron L. White, Coffeyville, Kansas, died June 4, 1944, aged 71 years.

#### MISCELLANEOUS

A course in "Ocular muscles" with demonstration classes will be given at the Northwestern University Medical School, 303 East Chicago Avenue, Chicago, by Dr. James W. White of New York, December 9th to 16th. For further information apply to Dr. B. Cushman, 25 East Washington Street, Chicago 2, Illinois.

In order to encourage scientific ophthalmic work, the Ophthalmological Society of Egypt will grant a prize to the value of Egyptian £E.20 for the most-valuable contribution brought before the annual congress of the Society. The subject for the competition is not restricted. Candidates desiring to enter the competition should send their articles not later than the beginning of December. Articles arriving after this fixed date cannot be entered for the competition but will be returned. The articles, in three typed copies, should carry a pseudonym accompanied by the actual name of the author enclosed in an envelope on which is written the pseudonym only. The address of the society is Dar El Hekma, 42 Kasr El Ainy Street, Cairo.

#### SOCIETIES

The newly elected officers of the Brooklyn Ophthalmological Society are as follows: Dr. Michael J. Buonaguro, president; Dr. Allen Hull, vice-president; Dr. Benjamin C. Rosenthal, secretary-treasurer; and Dr. Louis Freimark, associate secretary-treasurer.

At the ninth national assembly of the United States chapter of the International College of Surgeons, held in Philadelphia on October 3, 4, and 5, 1944, Dr. Edmund B. Spaeth pre-

sented a paper on "Aneurysm of circle of Willis from an ophthalmological standpoint."

Among the guest speakers at the sixteenth annual meeting of the Aero Medical Association of the United States which was held in Saint Louis, September 4th to 6th, were Drs. Meyer H. Halperin, Ross A. McFarland, and J. I. Niven who discussed "Alteration in the effects of altitude on vision by glucose and carbon dioxide." Dr. William R. Rowland spoke on "Night blindness in flying personnel—Observations on patients: Studies at the Army Air Force School of Aviation Medicine."

The one-hundred-and-third annual session of the State Medical Society of Wisconsin was held in Milwaukee, September 18th to 20th. A paper on "Surgical treatment of the extraocular muscles—Some suggestions" was given by Dr. Avery D. Prangen of Rochester, Minnesota.

Dr. Ramón Castroviejo, New York, was included among the guest speakers at the ninety-fourth annual session of the Medical Society of the State of Pennsylvania, September 19th to 21st. The title of his address was "Indications for keratoplasty and keratectomies"; it was illustrated with Kodachrome lantern slides and motion pictures.

Among the speakers at the health institute sponsored by the Philadelphia County Medical Society, held June 26th to 28th at the Board of Public Education was Dr. Edmund B. Spaeth who spoke on "Conservation of sight of school children."

At the fourteenth annual clinical conference of the Oklahoma City Clinical Society to be held October 23d to 26th Dr. George P. Guibor, Chicago, will be one of the guest speakers. The title of his lecture has not been announced.

#### PERSONALS

The Kansas State Board of Social Welfare has appointed Dr. William F. Abramson, Topeka, state supervising ophthalmologist for the division of service for the blind to succeed Dr. William W. Reed of Topeka.

Major S. Rodman Irvine has been transferred by the Army. His new address follows: A.A.F. Regional Hospital, Drew Field, Tampa, Florida.





## FOR REDUCTION OF INTRAOCULAR TENSION IN GLAUCOMA SIMPLEX

**T**HE reduction of intraocular tension obtained with the local conjunctival instillation of a 1.5 per cent solution of Doryl is both more pronounced and more prolonged than that obtained with a 2 per cent pilocarpine nitrate solution. An 0.45 gram bottle of Doryl is sufficient for the preparation of 30 cc. of a 1.5 per cent solution. The addition of a wetting agent is suggested to promote better permeation of the cornea.

*Doryl is also supplied in boxes of six 1 cc. ampuls, each containing  $\frac{1}{4}$  milligram of the drug, for subcutaneous injection for the relief of urinary retention.*

★ LITERATURE ON REQUEST ★

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CONCERNING THE RELATIONS OF THE DEVELOPING OPTIC NERVE  
TO THE RECESSUS OPTICUS AND THE HYPOPHYSIS IN YOUNG  
FOETUSES: A STUDY OF SEVEN HUMAN FOETUSES  
4 M.M. TO 40 M.M., INCLUSIVE

*By*  
HENRY C. HADEN



CONCERNING THE RELATIONS OF THE DEVELOPING OPTIC NERVE  
TO THE RECESSUS OPTICUS AND THE HYPOPHYSIS IN YOUNG  
FOETUSES: A STUDY OF SEVEN HUMAN FOETUSES  
4 M.M. TO 40 M.M. INCLUSIVE\*

HENRY C. HADEN  
*Houston*

The subject for this study was chosen as it seemed peculiarly appropriate for a lecture in honor of one who had contributed so much to an understanding of the pituitary.

The development of the hypophysis in lower animals has been studied for many years and a very extensive literature upon the subject has been acquired. This had not been so in the case of the human until in comparatively recent years. The description in the books on embryology, either the classics or the most modern, are meager and the illustrations mostly schematic. In these comparatively recent years certain investigators have covered the subject in the human very thoroughly but most of their studies have been made from cross sections and the only representation in their illustrations of the developing optic nerve in relation to the hypophysis is in wax plate reconstructions.<sup>1</sup> A number of years ago, I made a study of the development of the connective tissue frame work of the optic nerve with especial reference to the lamina cribrosa<sup>2</sup> and I have intended supplementing it with a description of the ectodermal frame work. So I had sections made of young foetuses in the horizontal plane of the optic nerve and in addition sagittal and frontal sections of the nerve region of the head. Many of these serial sections included positions in the brain with the developing hypophysis, the optic stalk, nerve, and recessus opticus.

The sections of the head which passed

through the horizontal plane of the optic nerve making longitudinal sections of it were kept in the same relation to the optic nerve, whether or not they were above or below the level of it, so they progressed from above downward through the recessus opticus and the third ventricle and then horizontally through the floor of the diencephalon including the eminentia chiasmaticus, tubercinereum, and infundibular recess and then continued down through Rathke's pouch and the primordium of the sella turcica.

In this way they presented the relations of these structures in a somewhat unique fashion. In order to have an intelligent understanding of the parts to be described the anatomic details of the region involved should be reviewed. The classical teaching is that the optic vesicle evaginates from the lateral wall of the anterior cerebral vesicle caudally very early and soon afterward the portion of it adjacent to the cerebral vesicle becomes narrow and the hollow stalk develops connecting the optic vesicle with the anterior cerebral vesicle. Shortly afterward the optic vesicle invaginates and forms the optic cup and the invagination extends brainward along the stalk (figs. 4 and 5). The invagination permits the nerve fibers which develop as axons of the neuroblasts in the mantle zone of the innerlayer of the optic cup at about the 14-m.m. age to grow back in the ventral wall of the stalk reaching the brain by the 20-m.m. age. At the sites of the optic evaginations from the brain there is a recess or furrow in the floor of the anterior cerebral vesicle passing from one optic vesicle to the oth-

\* Delivered before the College of Physicians, Section on Ophthalmology, Philadelphia, December 16, 1943.

er, called the recessus opticus (fig. 1). The teaching of certain embryologists is that the fibers of the optic nerve grow into the marginal zone of the optic recess and fill it, obliterating its lumen and thus form the optic chiasm. It is part of this thesis to show that although the fibers grow into the marginal zone of the recessus opticus they do not obliterate its lumen and when they reach the region of the diencephalic floor they turn slightly caudally and enter the eminentia chiasmatica into which they pass forming the primordium of the optic chiasm.<sup>3,4,5</sup> The lumen of the recessus opticus stays open after the chiasm has begun to have its classical appearance,<sup>6</sup> and remains as the most anterior recess in the floor of the third ventricle in post natal life.<sup>7</sup> To be properly oriented as to the location of the parts under discussion a study should be made of a sagittal section through the middle of the forebrain of a young embryo before the epithelial walls have begun to differentiate. The brain at the 4 m.m. age, the age at which this study begins, is divided into the three primary cerebral vesicles, prosencephalon, mesencephalon, and rhombencephalon. The section illustrated, a median sagittal one (fig. 1), leaves the middle of the neural tube just caudad to the anterior cerebral vesicle, the prosencephalon, but the prosencephalon is well seen. The ectodermal cells of its walls show no differentiation but contain many mitotic figures. The forebrain is flexed so as to be nearly parallel with the hindbrain and the body of the embryo. The anterior neuropore has not completely closed (fig. 1), and caudad to it is a stretch of wall, the lamina terminalis, which ends at a recess, the recessus opticus (fig. 1).<sup>8</sup> A line drawn almost vertically from behind the optic recess across the prosencephalon to the site of the future paraphysis will divide the prosencephalon into the telencephalon,

the most anterior part of the brain, and the diencephalon or interbrain, caudad to the line.<sup>3</sup> This places the recessus opticus in the telencephalon. The recessus opticus remains in the telencephalic portion of the third ventricle post natally. The lamina terminalis lying between the anterior margin of the optic recess and the anterior neuropore forms the lower part of the anterior wall of the third ventricle (fig. 1). The other special divisions of the floor of the third ventricle have not appeared at this age but their positions can be indicated which facilitates an understanding of its later development. All the structures in the floor of the third ventricle caudad to the optic recess are in the diencephalon. They are the eminentia chiasmatica, tubercinereum, infundibular recess, and manillary recess (fig. 1). The diencephalic floor is one of the most vital portions of the brain and I believe that obscure eye symptoms have their origin here besides those produced by neoplasm. The diencephalic floor differs very much in these young foetuses from the developed human and also from the older foetuses. This thesis concerns only those through the 40 m.m. age. When the infundibulum evaginates from the diencephalic floor (the floor of the third ventricle) it is not immediately caudad to the optic chiasm, as is often described,<sup>9</sup> for the reason that the optic chiasm does not exist at that time. The eminentia chiasmatica which lies immediately posterior to the optic recess indicates the position of the future chiasm and the evaginating infundibulum is quite some distance caudad to it and continues so until late in foetal life. The infundibulum evaginates about the 7 m.m. age and at the 8 m.m. age it is a short protrusion with a round knoblike extremity (fig. 3). As it grows and the stalk (stem) and infundibular process develop they extend backward horizontally and remain nearly parallel to the floor of the

third ventricle (diencephalic floor) until near the 40 m.m. age when they begin to show some downward tendency. The angle between the diencephalic floor and the infundibular stem (stalk) increases with the age of the foetus and the distance between the infundibulum and the location of the optic chiasm decreases as the angle increases.<sup>1</sup> At birth the infundibular stem is in close relation with the optic chiasm and it is practically perpendicular to the diencephalic floor. Below the floor of the diencephalon will lie the epithelial (Buccal) portion of the hypophysis. At this age it is only indicated by an evagination from the superior posterior wall of the stomodeum (fig. 1).<sup>10</sup> Systematic writers have divided the hypophysis into an anterior epithelial portion derived from Rathke's pouch, a diverticulum from the epithelial wall of the stomodeum, and a nervous posterior portion derived from the floor of the diencephalon. The epithelial portion is subdivided into three parts, pars anterior (pars distalis), pars intermedia (pars infundibularis), and pars tuberalis. The neural portion, pars nervosa, is usually divided into the infundibular stalk and infundibular process. Tilney is more detailed and divides it into the median eminence of the tuber cinereum, the infundibular bulb, infundibular stem, and infundibular process.<sup>1</sup>

It has been taught that quite early in foetal life a diverticulum appears in the posterior superior wall of the stomodeum, Rathke's pouch (figs. 1 and 2), and an evagination, from the diencephalic floor, the infundibulum, grows down to meet it (fig. 3). When it does the pouchlike diverticulum becomes concave dorsally and two hornlike processes, the tuberal processes, grow up to either side of the infundibulum (figs. 6 and 7). This theory has been denied by certain investigators. It is not in the province of this paper to discuss this. However, I may state that

there are numerous mitotic figures in the cells of the wall of the anterior cerebral vesicle of the 4 m.m. embryo in the region of the future diencephalic floor and that the epithelial wall of the stomodeum seen in median sagittal sections is not in contact with the vesicle wall. In para transverse sections of an 8 m.m. embryo Rathke's pouch is seen as a flat oval (fig. 2) lying below the forebrain. Some sections caudad, the primordium of the infundibulum, which is short and ends in a knoblike process, is seen approaching (fig. 3) Rathke's pouch, which is not changed from the oval shape and is not in contact with the floor of the brain.

In embryos of the 10 m.m. age Rathke's pouch has become concave dorsally under the approaching infundibulum and presents the tuberal processes (figs. 6 and 7). The infundibulum is some distance caudad to the optic stalks.

In foetuses of the 20 m.m. age much more detailed development has occurred. The head of the 20 m.m. foetus illustrated was bisected in the middle in order to show horizontal sections of one optic nerve and cross sections of its fellow (fig. 8). Fortunately for this study the bisection passed well to one side of the middle and thus the structures in the center of the brain were included in the transverse sections (fig. 8, those cutting the optic nerve in a longitudinal direction). In them some fibers from the ganglion cells of the retina are seen to have grown back as far as the brain, and have passed through the inferior posterior wall of the optic recess into the eminentia chiasmatica. When seen superior to the level of the nerve the optic recess is a wide open space communicating with the third ventricle (fig. 9). At a little lower level the central portion of the lumen of the optic recess disappears because the sections have passed below it (fig. 10). At this level either end of the optic recess

tapers (fig. 10) to join the lumen of the optic stalk which is still patent in the posterior third of the optic nerve (fig. 11 higher magnification; fig. 12 higher magnification, cross section of the fellow nerve in its posterior portion). Below the level of the patent lumen the glial nuclei in the nerve are arranged irregularly, not in definite rows (fig. 13), and among them pass the nerve fibers which enter the floor of the brain, below and caudad to the lumen of the optic recess, and pass into the eminentia chiasmatica in the floor of the diencephalon (figs. 13 and 14). Posterior to the eminentia is the tuber cinereum with which it is continuous. In the caudal portion of the tuber cinereum is a lozenge shaped opening (fig. 14 higher magnification of fig. 13) leading into the infundibulum, flanked on either side by the tips of the tuberal processes of Rathke's pouch (fig. 14 higher magnification). At a lower level the tuberal processes, into which the lumen of Rathke's pouch extends, lie under and in contact with the floor of the diencephalon and between them is the infundibular process (figs. 15, 16 higher magnification). The infundibular process is located some distance caudad to the primordium of the optic chiasm. Below this level lies the typically shaped Rathke's pouch (fig. 17) with large lumen and tuberal processes and the primordium of pars intermedia (pars infundibularis) and infundibular process. Caudad to this is a condensed area of mesenchyme, the primordium of the dorsum sella (fig. 17). As the sections pass lower the lumen of the pouch disappears and its ventral wall is seen (fig. 18).

Twenty-four m.m. age. The optic recess communicates with the third ventricle through a wide opening (fig. 20). Below the level of its middle portion the sections pass into its floor (fig. 21) but laterally the lumen is open and the recess

tapers to the optic nerves as in the 20 m.m. age. Below the level of the third ventricle lie the chiasma primordium (into which the optic nerve fibers have begun to grow) and the tuber cinereum in the diencephalic floor (fig. 22). In the caudal portion of the tuber cinereum there is an opening similar to the one in the 20 m.m. foetus which leads into the infundibulum. The infundibular opening is quite some distance caudad to the primordium of the optic chiasm (fig. 22). At a lower level the optic nerve fibers have entered the chiasma primordium which is continuous with the tuber cinereum (fig. 23). Under the caudal portion of the tuber cinereum lie the infundibular stem and process (figs. 23 and 24) flanked by the tuberal processes of Rathke's pouch into which the lumen of the pouch extends (fig. 24). Below the level of the diencephalic floor lies the typically shaped Rathke's pouch together with the infundibular process and pars intermedia (fig. 25). Some sections lower than this the tips of the tuberal processes are curved more toward forming the anterior portion of the pars anterior (distalis; fig. 26). The remains of the stalk is patulous at this level. At a still lower level the tips of the processes are connected by a series of small epithelial rosettes or acini (fig. 27), and caudad to the infundibular process is a condensed area of mesenchyme, the primordium of the dorsum sella.

In the 29 m.m. age the optic nerve showed much more development as regards the nerve fibers but the glial cells were not lined up in regular columns dividing the funiculi (fig. 28; the illustrations of the 29 m.m. age foetus are of half of a head which had been bisected in the middle). The fibers had grown into the chiasma eminence, posterior to which and continuous with it was the median eminence of the tuber cinereum with its



horizontally extended cavity (fig. 28). Above the level of the nerve fibers (fig. 29) the lumen of the optic recess was open and communicated with the third ventricle which was continuous with the horizontal cavity<sup>1</sup> of the median eminence of the tuber cinereum. When seen in cross section the optic nerve of the fellow eye, after it had entered the cranium, presented a lumen in its upper portion with a zone of nuclei above and a broader zone of fibers below (fig. 30 higher magnification). Farther inward the lumen of the nerve passed into the lumen of the recessus opticus (fig. 31 higher magnification), below the lumen of which the fiber zone was much reduced in size (fig. 31 higher magnification). Deeper in under the tuber cinereum the epithelial hypophysis was seen in half section, its tuberal process reaching nearly to the median eminence (fig. 32 higher magnification). The remains of the stalk of Rathke's pouch with a small lumen was seen. Sections farther down showed no lumen in the stalk which was reduced to a solid cord of epithelial cells.

In a foetus of the 40 m.m. age, sectioned at a level above the optic nerve and chiasm, the optic recess was seen to be widely open and communicating with the third ventricle (fig. 33). The third ventricle at this age is a narrow slitlike cavity whose walls are in contact in the central portion (fig. 34 higher magnification). At a lower level the optic nerve fibers were seen to enter the chiasm caudad to the optic recess (fig. 35 higher magnification) and when the sections reached a deeper level the lumen of the optic recess disappeared from view (fig. 36 higher magnification) not because it had been filled with nerve fibers but because the sections had passed below it and lay in the floor of the diencephalon. Caudad to the chiasm lay the tuber cinereum with which it was

continuous (fig. 36 higher magnification). At a still lower level and some distance caudad to the optic chiasm there was a lozenge-shaped opening in the tuber cinereum (fig. 37 higher magnification) similar to the one in the younger foetuses, the infundibulum (infundibular bulb). It was partially flanked by the tuberal processes as it was in the younger foetuses. At a lower plane below the floor of the tuber cinereum the infundibular stalk passes into the infundibular process (fig. 38 higher magnification). The latter is partially surrounded by the pars intermedia which shows glandular arrangement. Below this level the lateral portions of the tuberal processes which had had large cavities continuous with the lumen of Rathke's pouch in the younger foetuses, were filled with epithelial cells, acini, and mesenchyme to form the pars distalis (fig. 39 higher magnification) while their medial parts remain in contact with the tuber cinereum and form the pars tuberalis (figs. 39 and 40 higher magnification). At a lower level (fig. 41) the sections passed below the floor of the brain and through the primordium of the sella turcica (fig. 41) in which lay the pars distalis separated from the pars intermedia by the residual lumen of Rathke's pouch and caudad to and in contact with the pars intermedia was the infundibular process. These will be the contents of the sella turcica, covered by the diaphragma sella postnatally.

The study of these foetuses has revealed a wealth of interest in the developing mesenchyme and details of the histology of the hypophysis itself but this thesis pertains to morphology and topography alone. It is an endeavor to present the recessus opticus in a more rational light and to show the relation of the developing optic nerve, chiasm and hypophysis in early foetal life.

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These illustrations were made from unretouched photographs of sections of human embryos and foetuses in my private collection.

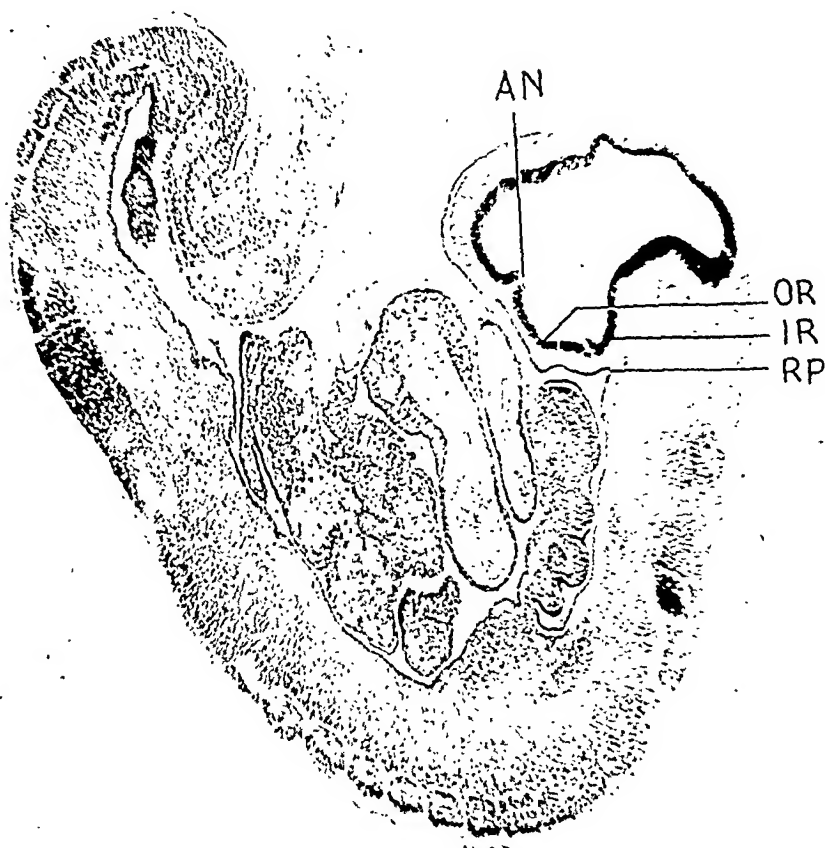


Fig. 1 (Haden). Median sagittal section of 4 m.m. embryo passing through anterior cerebral vesicle (prosencephalon). AN, anterior neuropore; OR, recessus opticus; IR, position of infundibular recess; section of floor of vesicle from (AN to OR) is lamina terminalis. Caudal to OR is diencephalic floor. Immediately caudal to OR is chiasma eminence. RP, evagination from stomodaeum, Rathke's pouch. There is no mesoderm between the floor of the vesicle and the surface ectoderm between the anterior neuropore and Rathke's pouch.

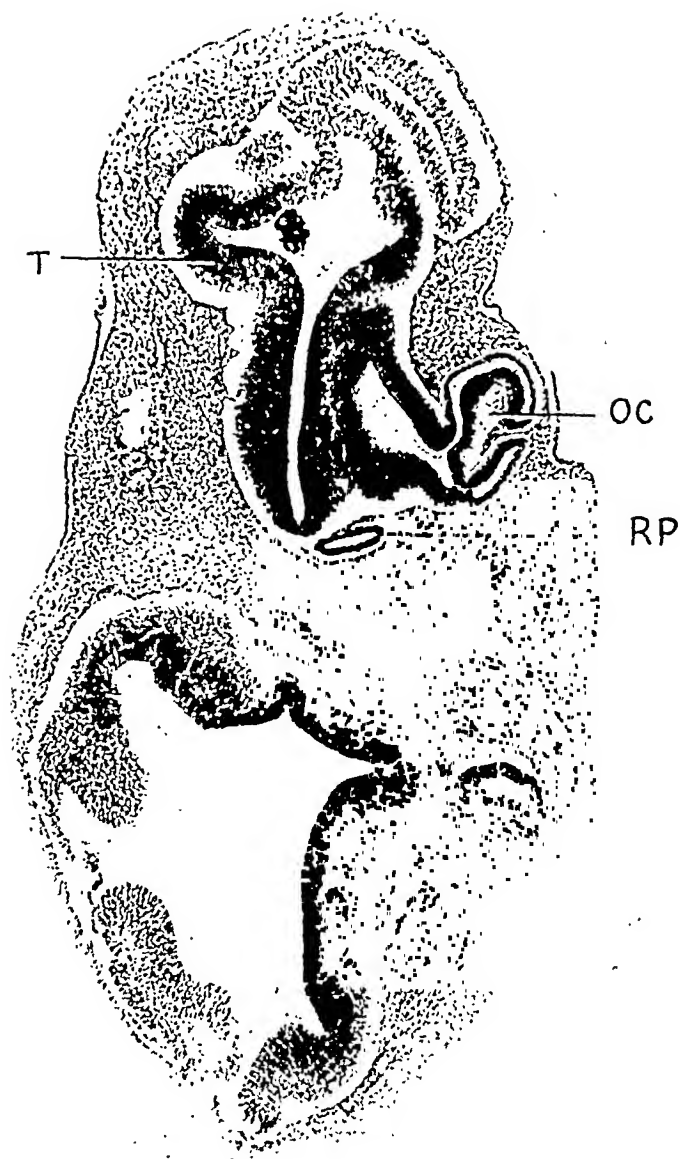


Fig. 2 (Haden). Paratransverse section of head of 8 m.m. embryo. T, telencephalon; OC, optic cup; RP, Rathke's pouch below brain.

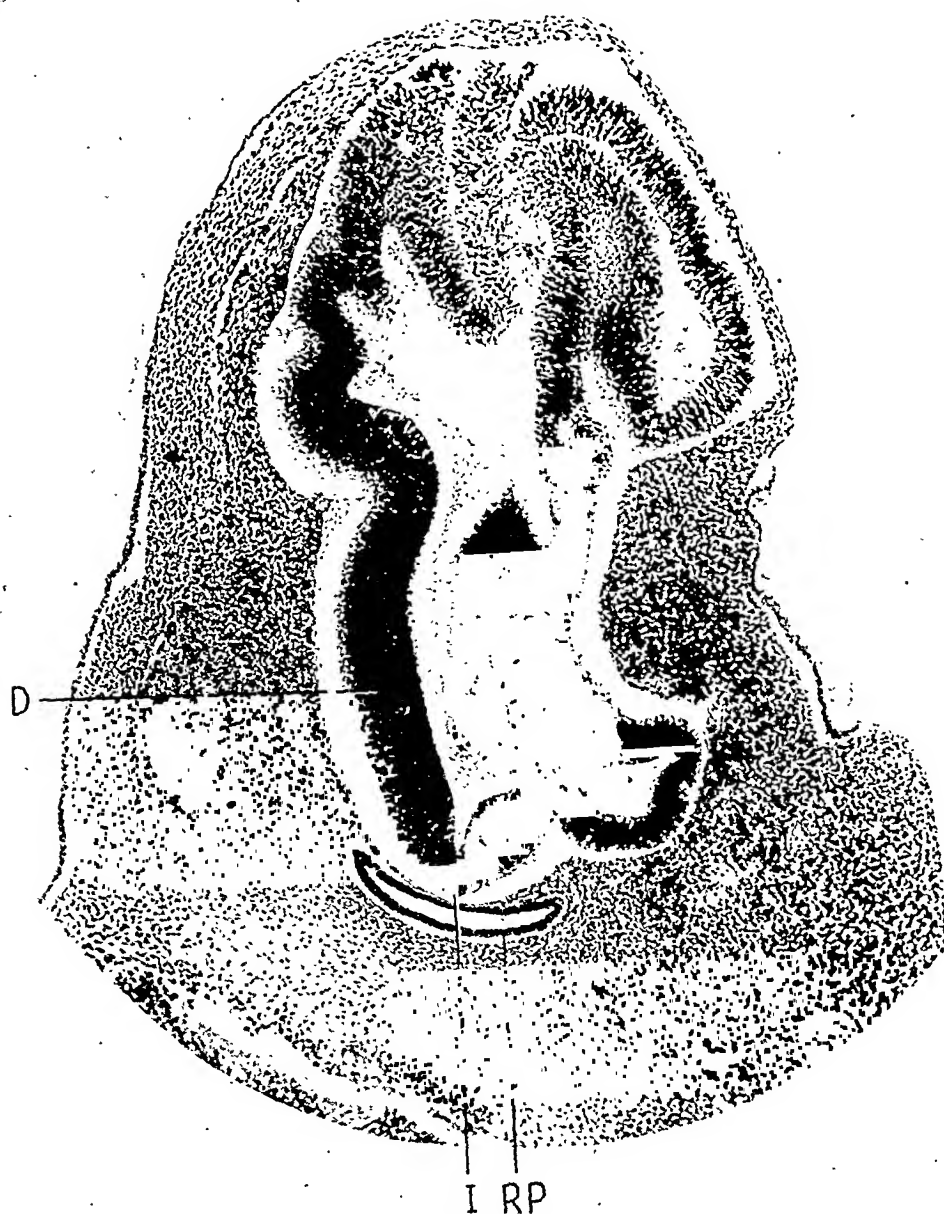


Fig. 3 (Haden). Paratransverse section of head of 8 m.m. embryo. Caudad to figure 2, higher magnification. D, diencephalon; I, infundibulum with knoblike extremity below which is RP, Rathke's pouch.

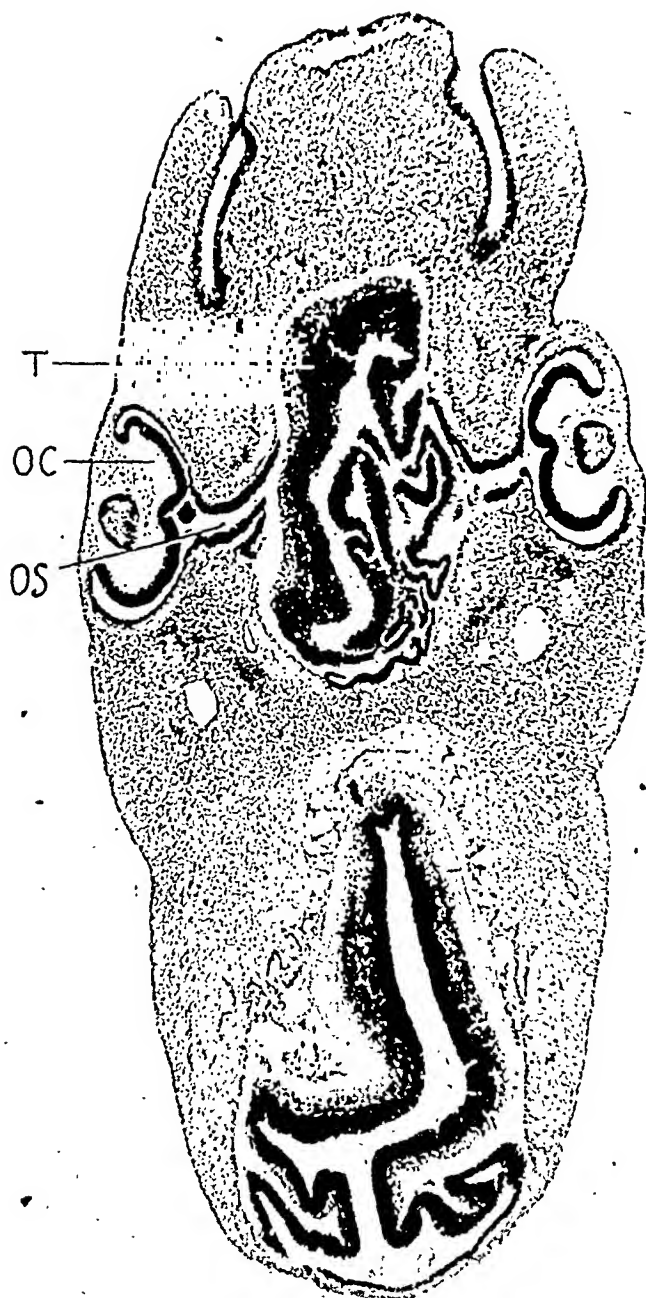


Fig. 4 (Haden). Transverse section of head of 10 m.m. embryo.  
T, telencephalon; OC, optic cup; OS, optic stalk.

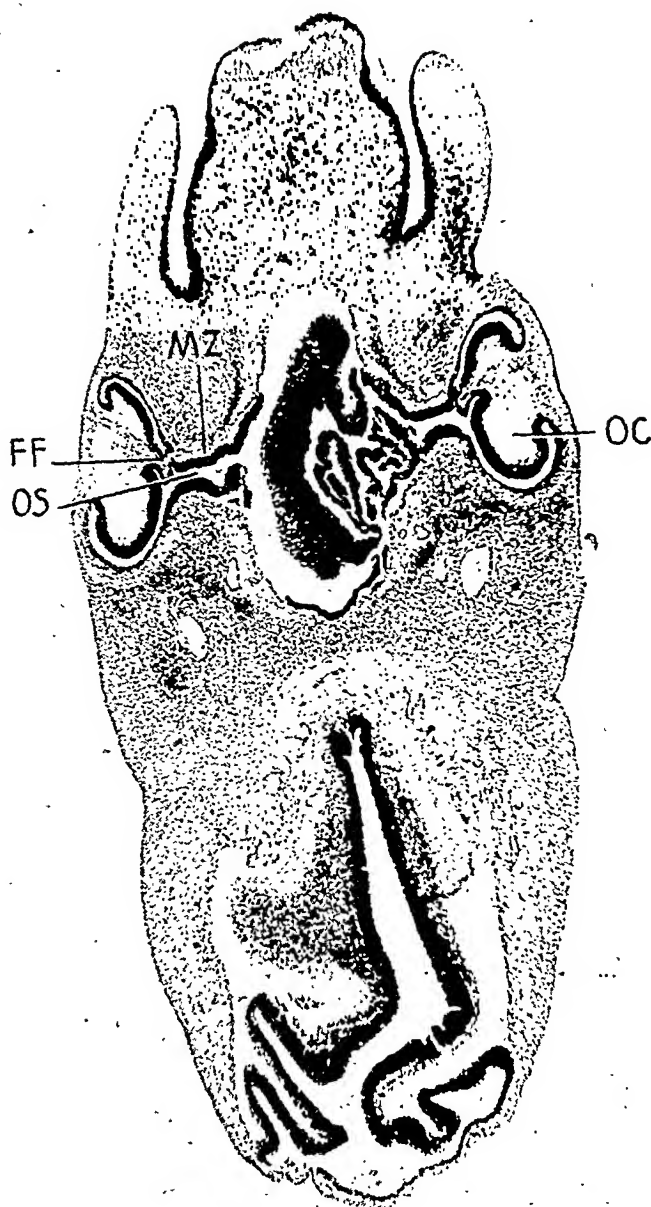


Fig. 5 (Haden). Transverse section of head of 10 m.m. embryo. Lower level than figure 4. OC, optic cup; OS, optic stalk; FF, foetal fissure; MZ, marginal zone of stalk wall.



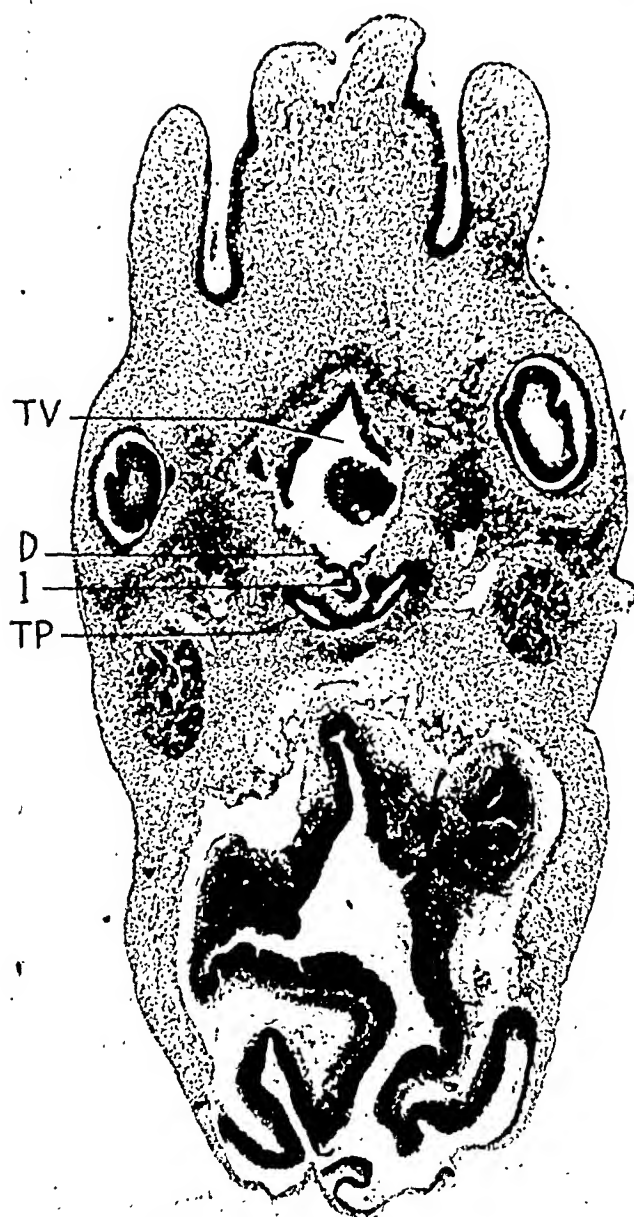


Fig. 6 (Haden). Transverse section of 10 m.m. embryo lower level than figure 5. TV, diencephalic portion of third ventricle which extends into, I, infundibulum, primordium of stem and process; TP, Rathke's pouch with tuberal processes; D, diencephalon.

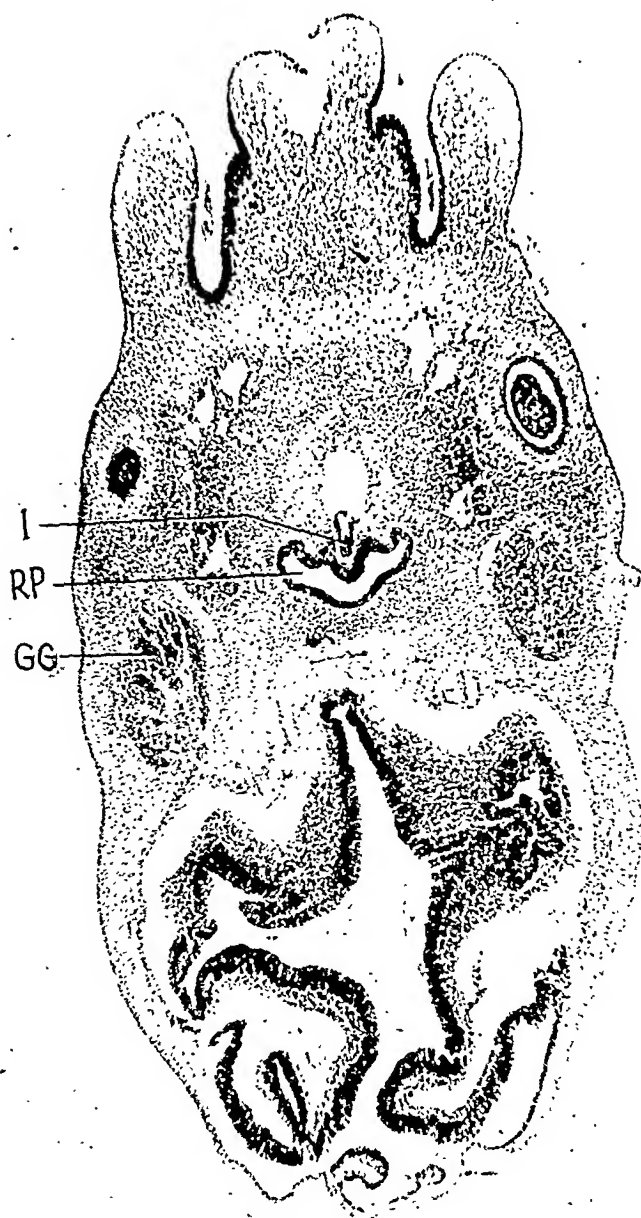


Fig. 7 (Haden). Transverse section of 10 m.m. embryo lower level than figure 6 below diencephalic floor. I, tip of infundibulum and RP, Rathke's pouch; GG, Gasserian ganglion.



Fig. 8 (Haden). Transverse section of 20 m.m. foetus passing horizontally through optic nerve. The head was bisected but bisection passed well to side of middle. ON, optic nerve; CP, chiasma primordium; IR, infundibular recess of third ventricle; GG, Gasserian ganglion.

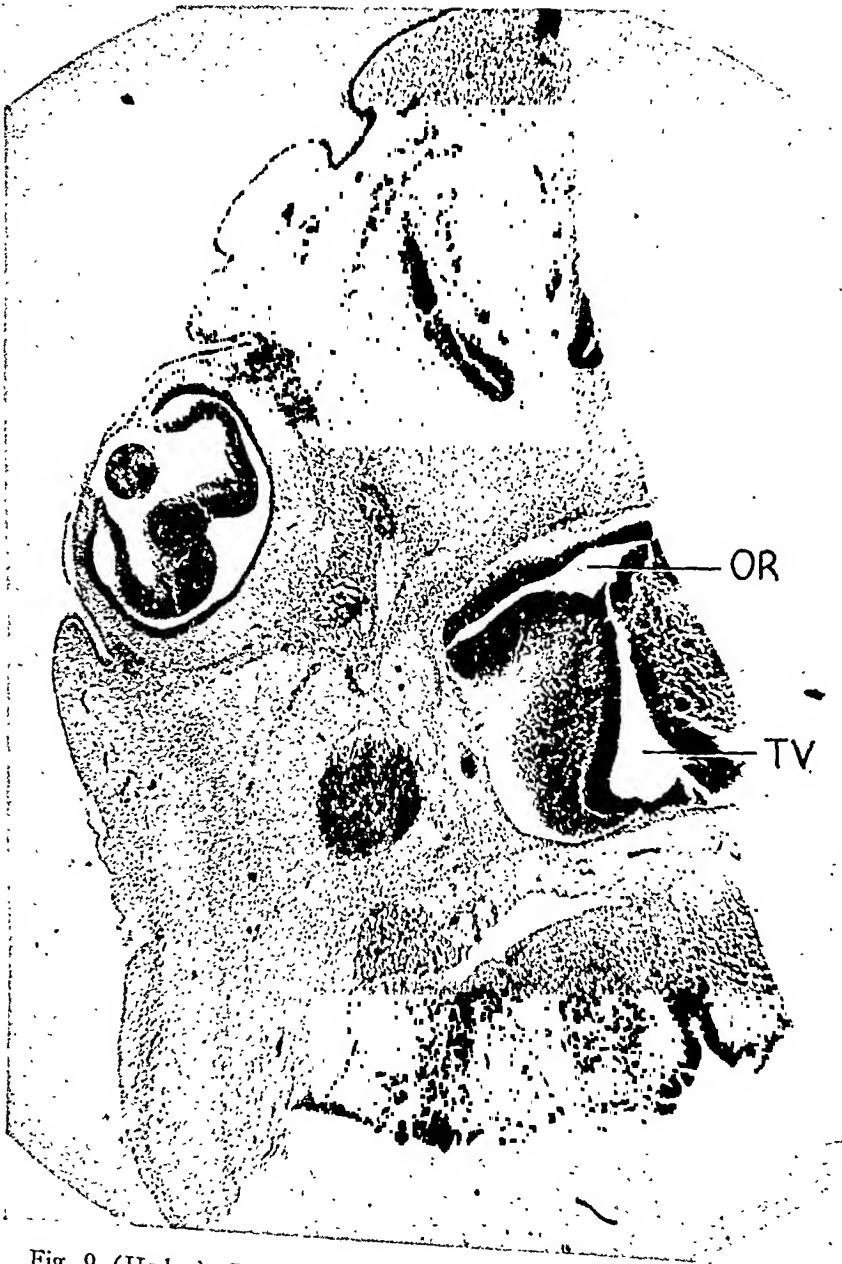


Fig. 9 (Haden). Transverse section of 20 m.m. foetus at higher level than figure 8 but in the same plane. OR, optic recess communicating with the TV, third ventricle.

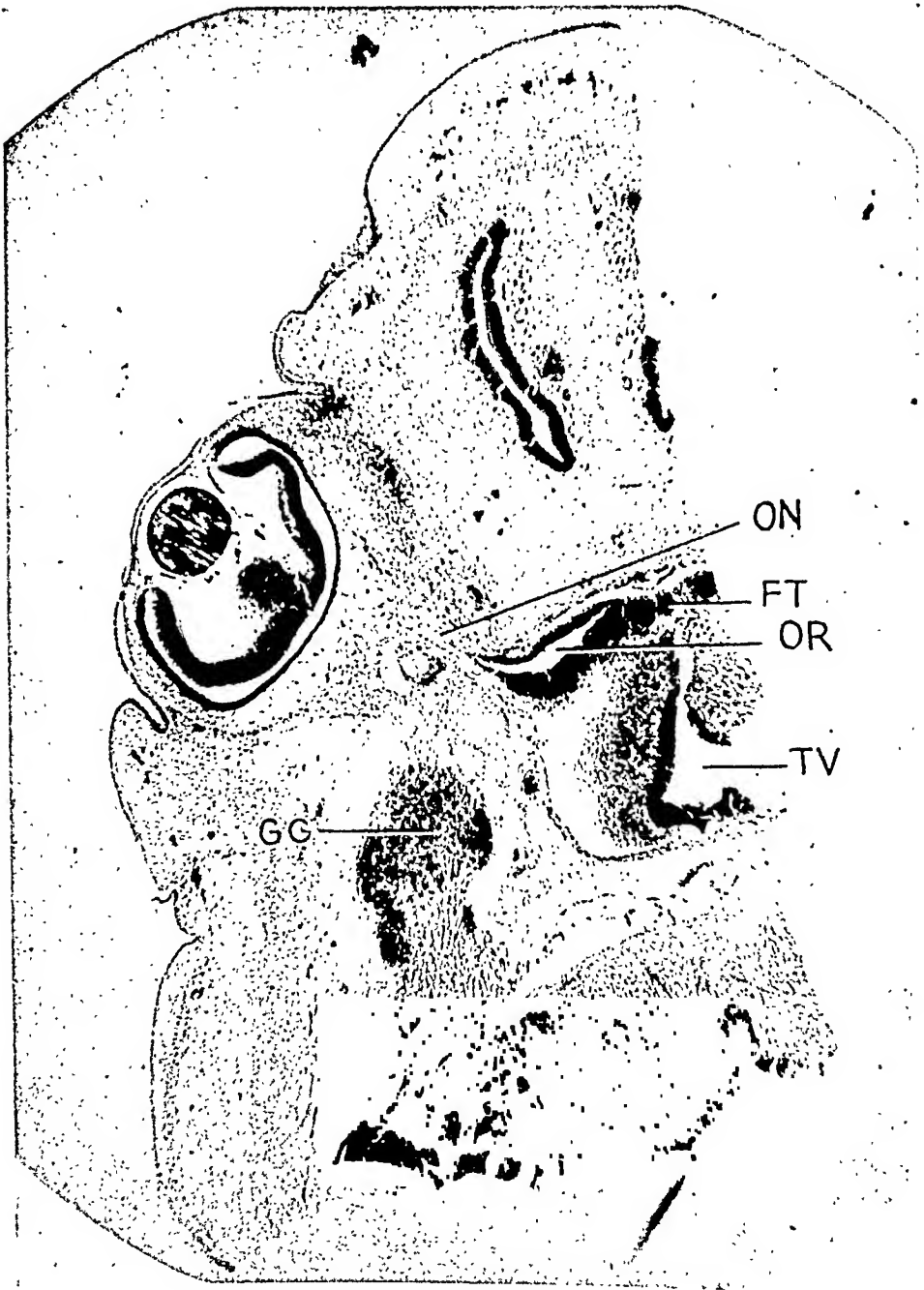


Fig. 10 (Haden). Transverse section of 20 mm. fetus at slightly lower level than figure 9 but in the same plane. OR, optic recess either end of which tapers to ON, optic nerve, and is continuous with its residual lumen; FT, section passes below lumen of central portion of optic recess and lies in telen- cephalic floor. TV, third ventricle; GG, Gasserian ganglion.

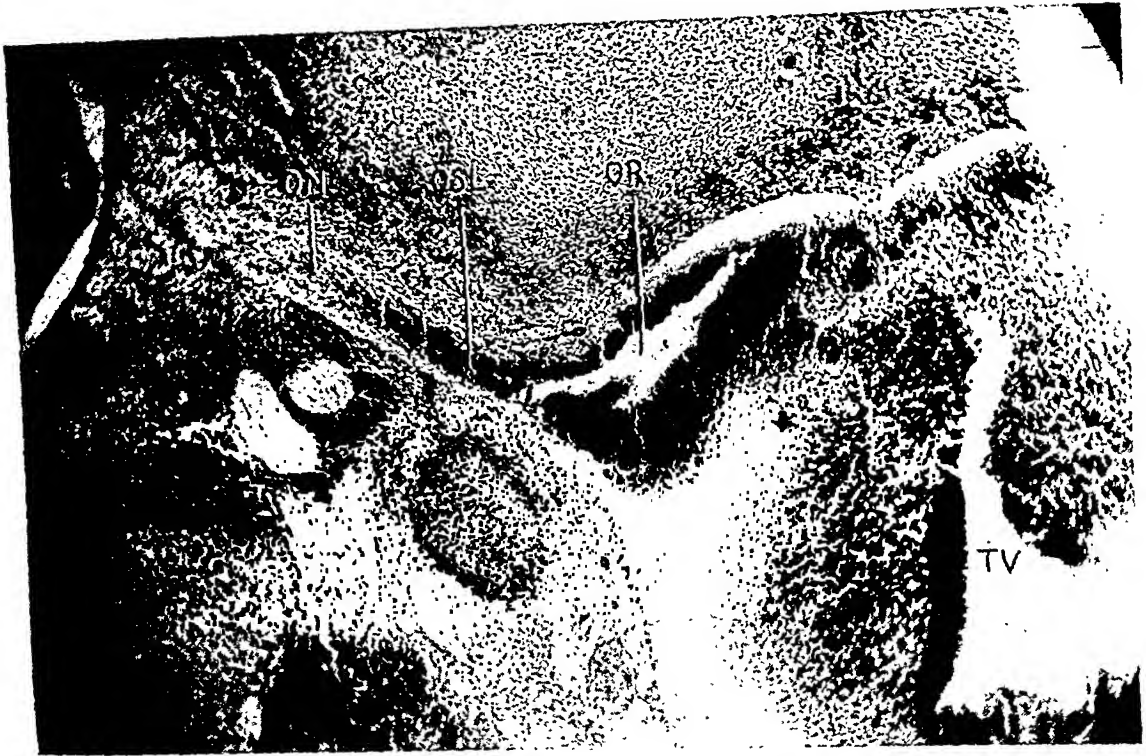


Fig. 11 (Haden). Transverse section of 20 m.m. foetus at a lower level than figure 10 but in the same plane. Higher magnification. OSL, the residual optic stalk lumen is open in the posterior third of ON, optic nerve, and communicates with OR, optic recess; TV, third ventricle.

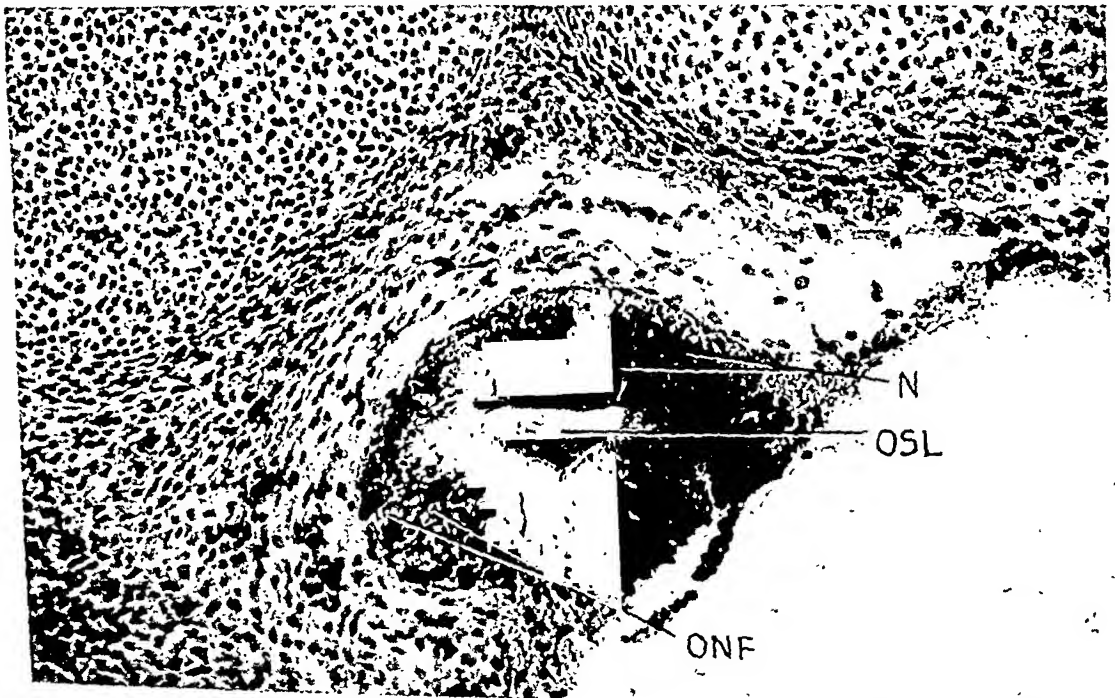


Fig. 12 (Haden). Cross section of the fellow nerve of the 20 m.m. foetus in its posterior third. Higher magnification. N, nuclei; OSL, optic stalk lumen; ONF, optic nerve fibers.



Fig. 13 (Haden). Transverse section of 20 m.m. foetus same plane as figure 11 but below level of lumen of nerve. ON, optic nerve, fibers of which enter floor of OR, optic recess, and turn caudally into CE, chiasma eminence. TC, tuber cinereum with lozenge-shaped opening in its posterior portion, the I, infundibular recess.



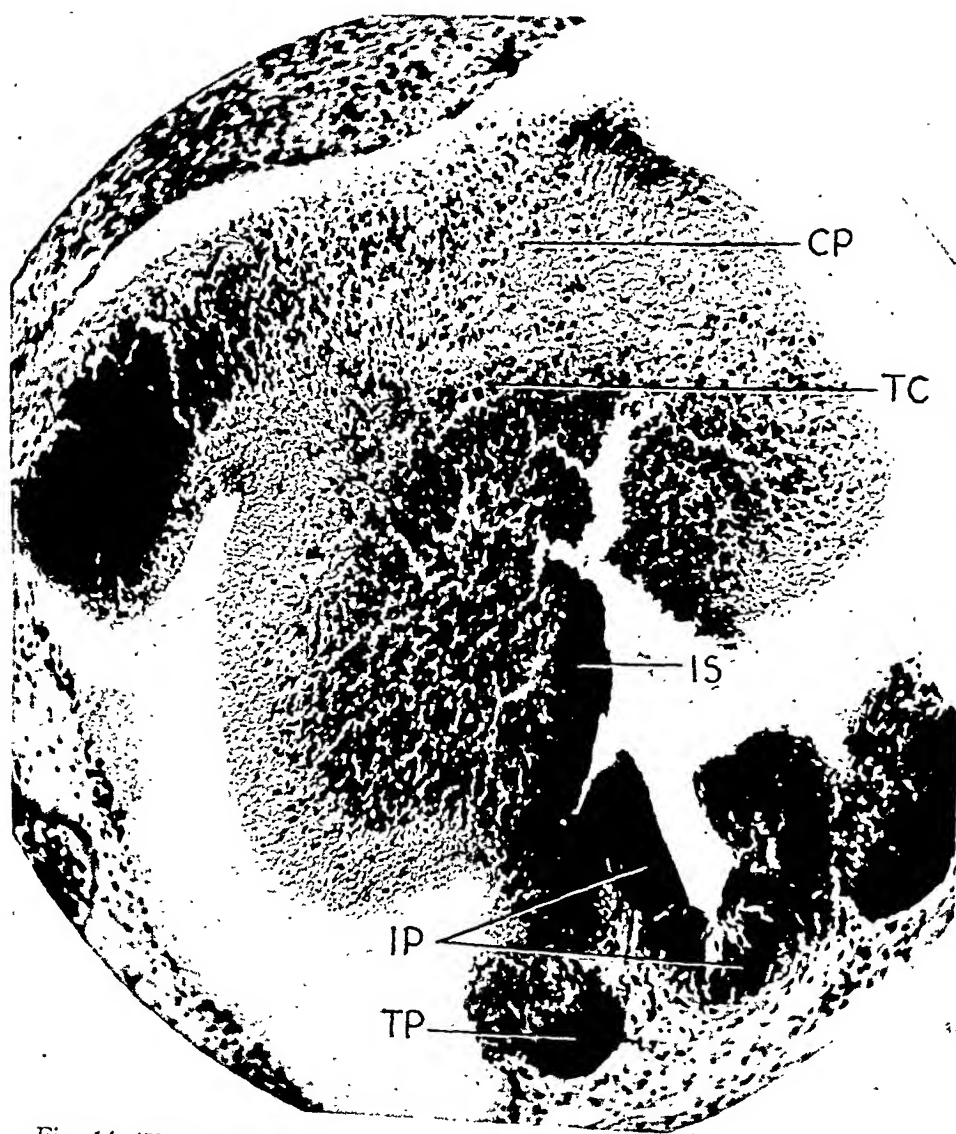


Fig. 14 (Haden). Higher magnification of posterior portion of figure 13. CP, chiasma primordium (chiasma eminence); optic nerve fibers above on right turn caudally to enter chiasma eminence; TC, tuber cinereum; section passes obliquely through IS, infundibular stalk (stem) and IP, infundibular process. TP, tip of tuberal process of Rathke's pouch.



Fig. 15 (Haden). Transverse section of 20 m.m. foetus at lower level than figure 13 but in the same plane. CP, chiasm primordium; TC, tuber cinereum; IP, infundibular process flanked by TP, tuberal processes of Rathke's pouch with lumen.



Fig. 16 (Haden). Transverse section of 20 m.m. foetus; higher magnification at slightly lower level than figure 15. CP, optic nerve fibers in chiasm primordium; TC, tuber cinereum; IP, infundibular process; TP, tuberal processes; RPL, Rathke's pouch with lumen.

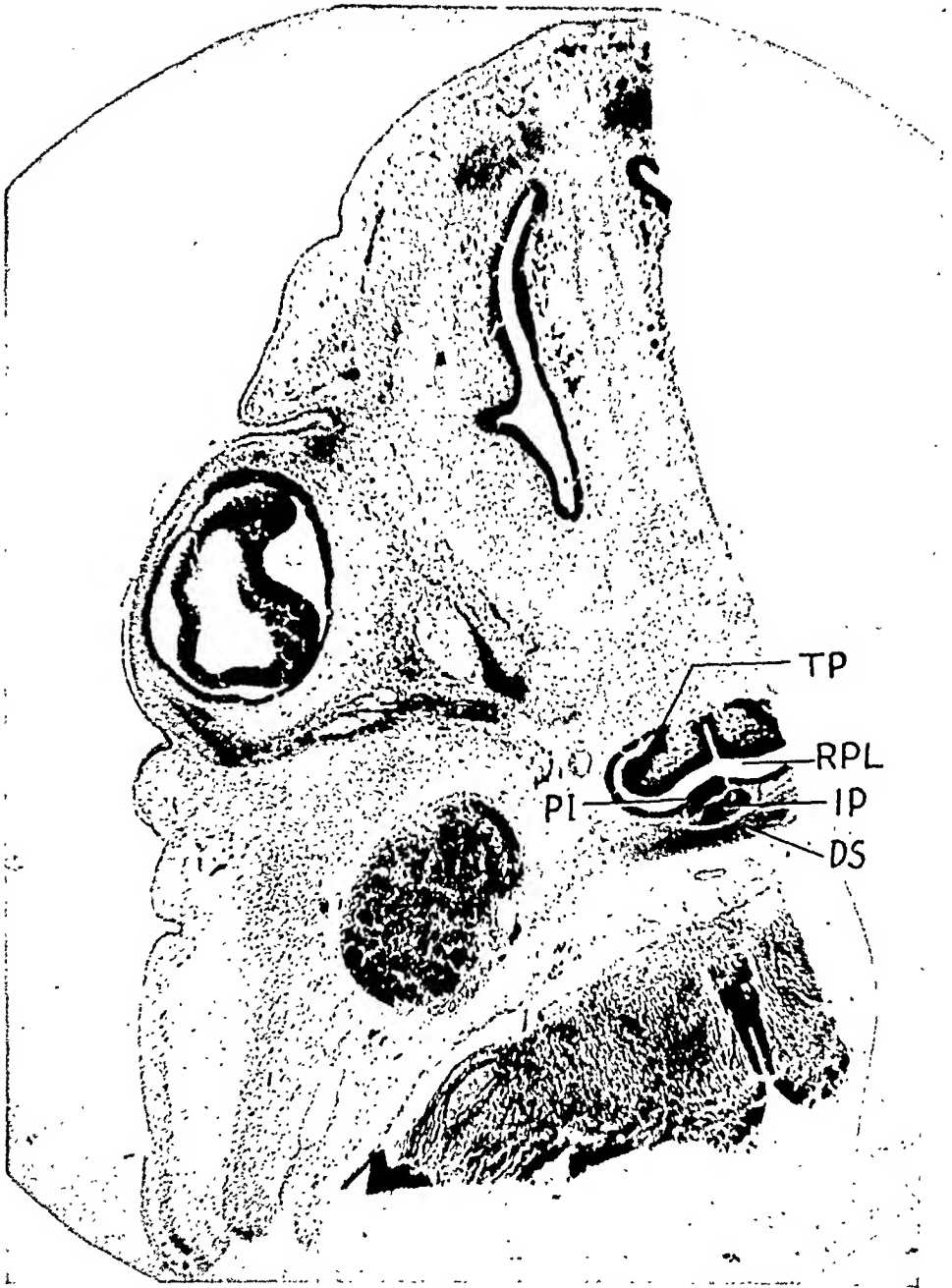


Fig. 17 (Haden). Transverse section of 20 mm. foetus at lower level than figure 16 but in the same plane. RPL, lumen of typically shaped Rathke's pouch; TP, tuberal process; PI, pars intermedia (pars infundibularis); IP, infundibular process; DS, dorsum sella primordium,

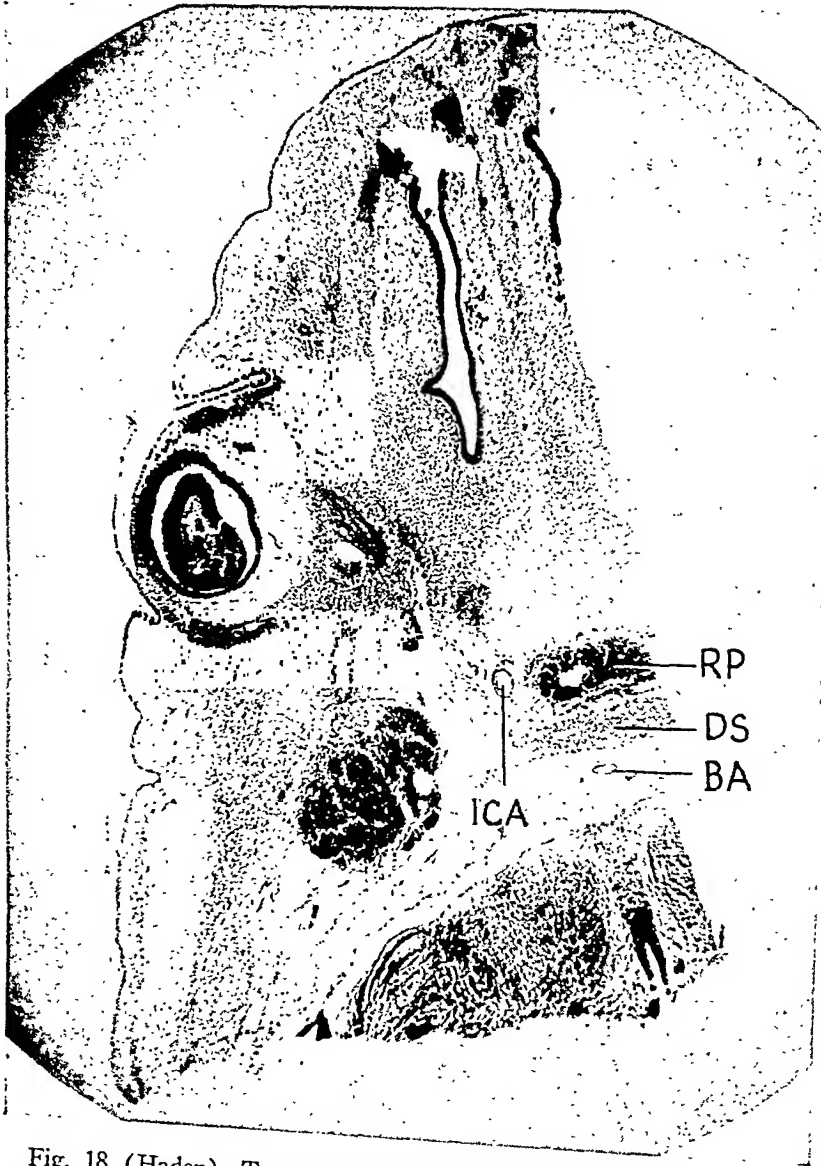


Fig. 18 (Haden). Transverse section of 20 m.m. foetus at slightly lower level than figure 17 but in the same plane. Inner surface ventral wall of RP, Rathke's pouch; DS, dorsum sella primordium; BA, basilar artery; ICA, internal carotid artery.



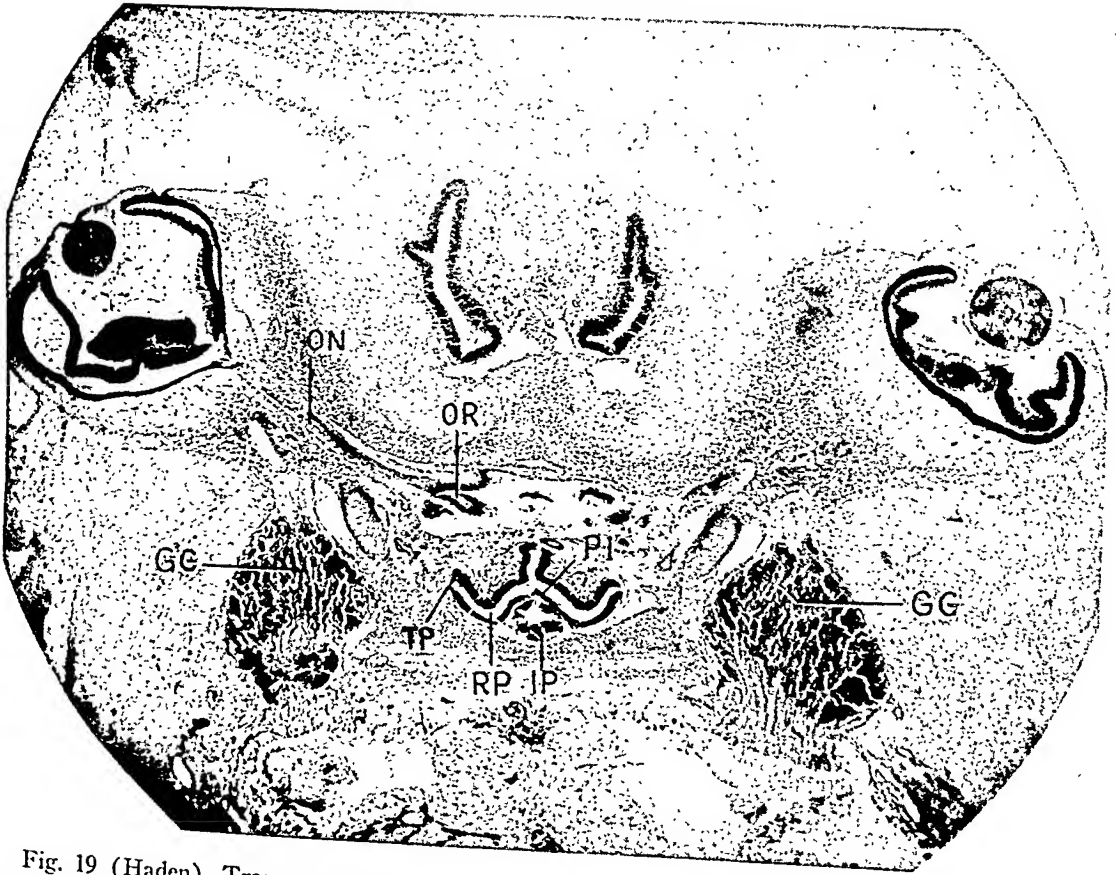


Fig. 19 (Haden). Transverse section of head of 18 m.m. foetus. ON, optic nerve; OR, optic recess; RP, Rathke's pouch; IP, infundibular process; PI, pars intermedia; TP, tuberal process; GG, Gasserian ganglion.



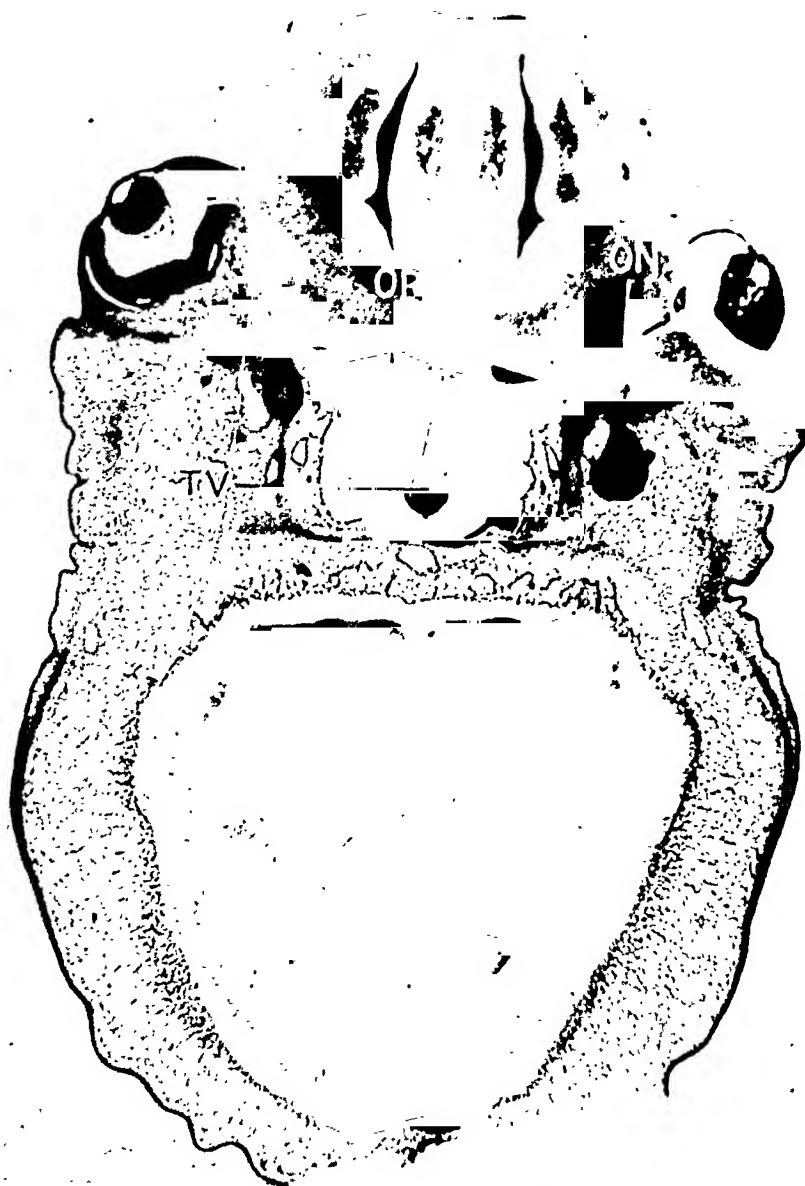


Fig. 20 (Haden). Transverse section of 24 m.m. foetus. In the plane of the ON, optic nerves; OR, optic recess communicating with the TV, third ventricle.

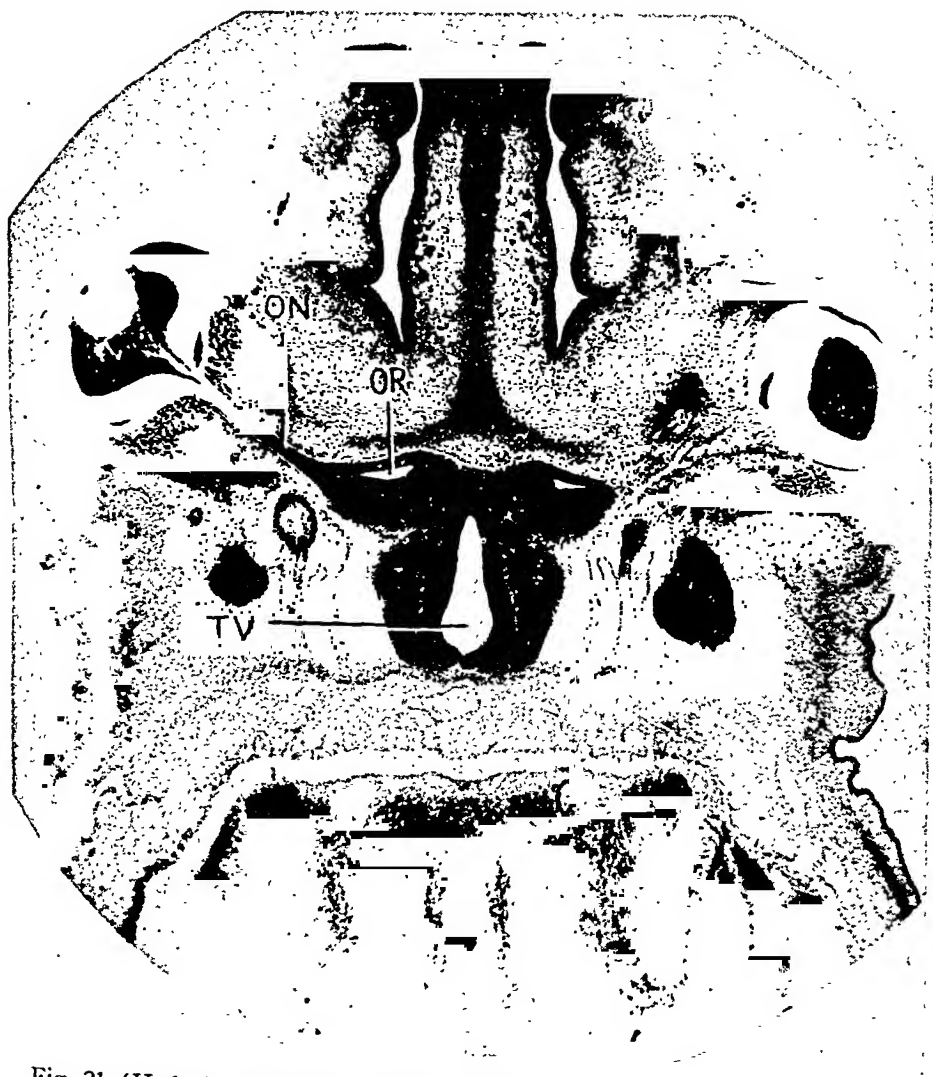


Fig. 21 (Haden). Transverse section of 24 m.m. foetus at slightly lower level but in the same plane as figure 20. Central part of OR, optic recess, has disappeared as section has passed below it. Either end of recess tapers to ON, optic nerves; TV, third ventricle.

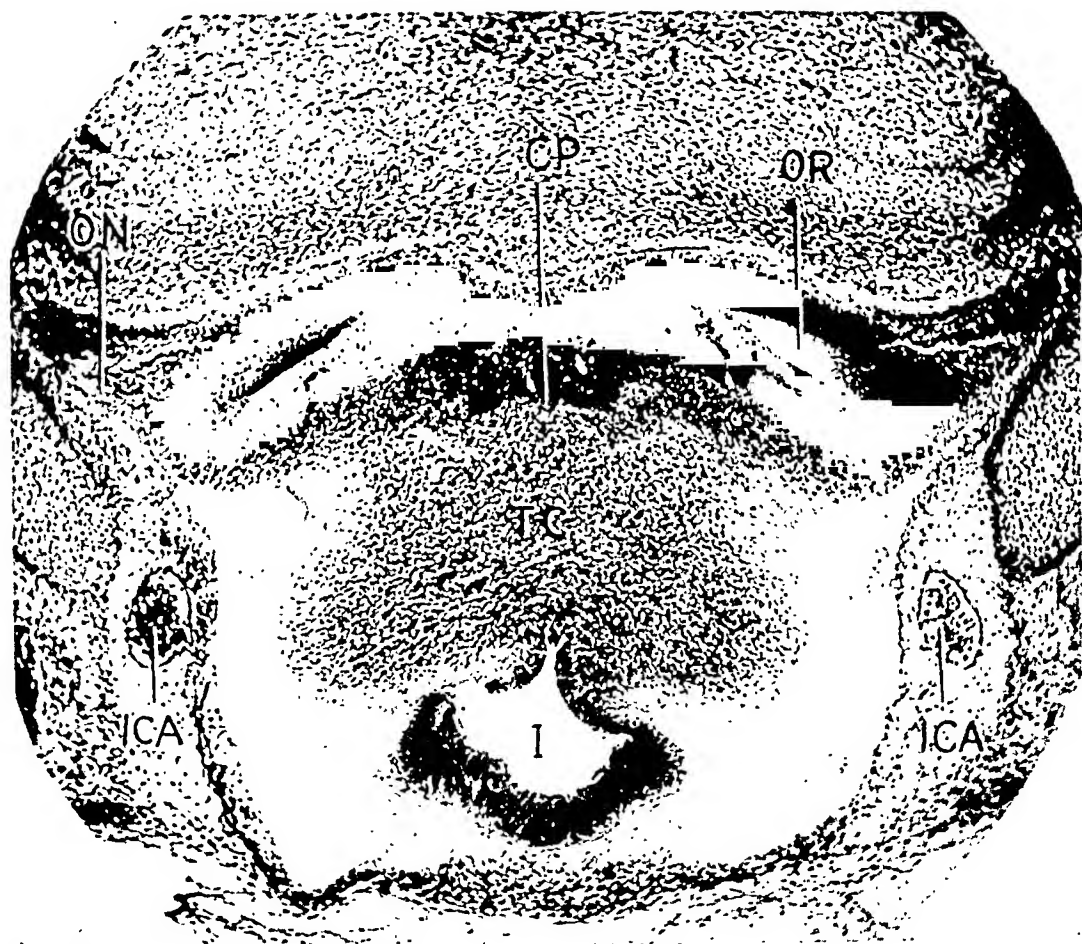


Fig. 22 (Haden). Transverse section of 24 m.m. foetus, higher magnification. Lower level than figure 21 but in the same plane. OR, lumen of optic recess; ON, optic nerve on either side; CP, chiasm primordium; TC, tuber cinereum; with opening in its caudal portion leading into I, infundibulum, note distance between primordium of optic chiasm and infundibulum; ICA, internal carotid artery.

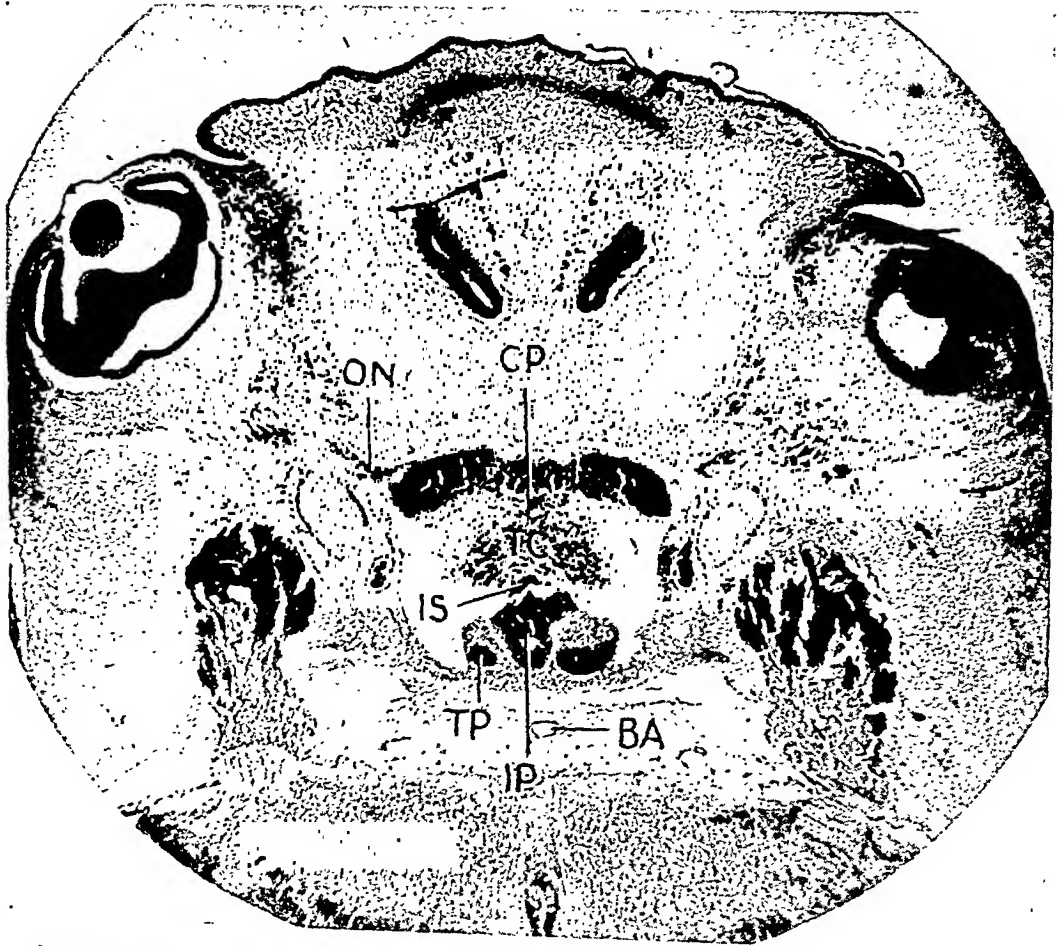


Fig. 23 (Haden). Transverse section of 24 m.m. foetus at lower level but in the same plane as figure 22. CP, chiasm primordium; ON, optic nerve; TC, tuber cinereum; IS, infundibulum stalk (stem) cut obliquely; IP, infundibular process; TP, tuberal process; BA, basilar artery.



Fig. 24 (Haden). Transverse section of 24 m.m. foetus at lower level than figure 23. CP, chiasm primordium; TC, tuber cinereum; IS, infundibular stalk (stem) where cut; IP, infundibular process with central lumen; PI, pars intermedia (infundibularis); TP, tuberal processes; GG, Gasserian ganglion.

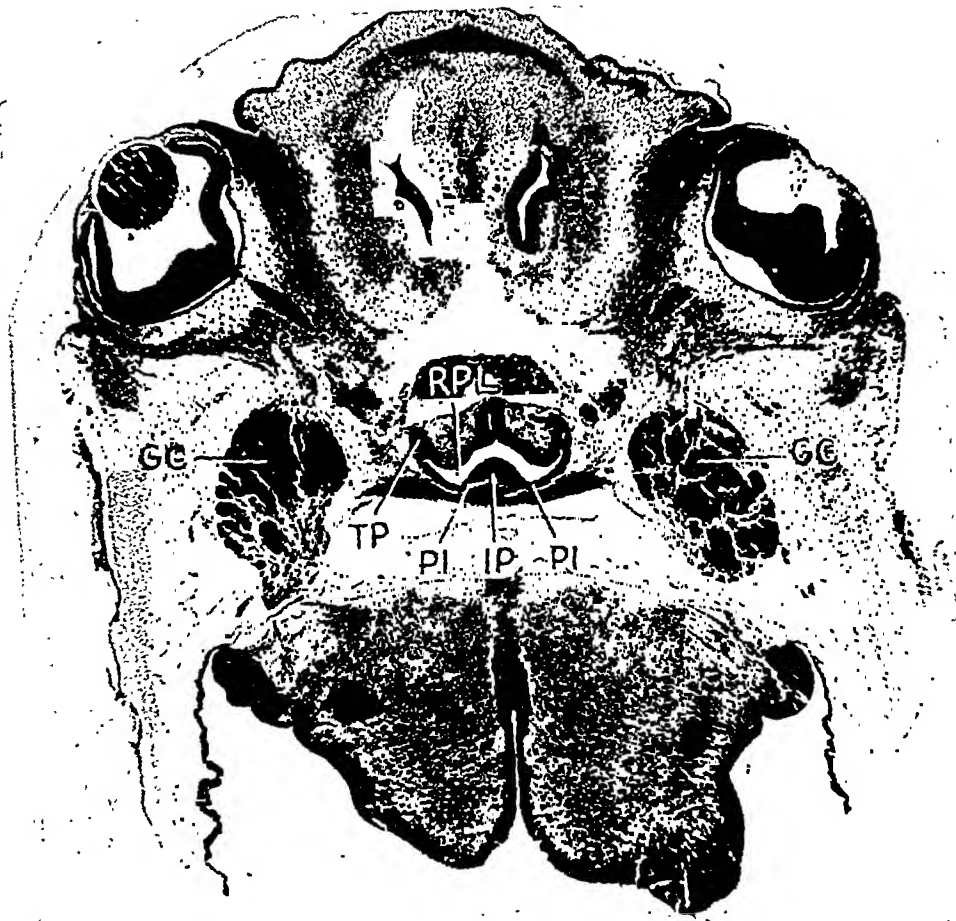


Fig. 25 (Haden). Transverse section of 24 m.m. foetus in same plane as figure 24 but at lower level. RPL, typically shaped Rathke's pouch; IP, infundibular process; PI, pars intermedia (pars infundibularis); TP, tuberal process; GG, Gasserian ganglion.



Fig. 26 (Haden). Higher magnification transverse section of 24 m.m. fetus at lower level than figure 25. Ac, acini, rosettes; RPL, Rathke's pouch lumen; RPS, Rathke's pouch stalk with lumen; TP, tuberal processes; PI, pars intermedia; IP, infundibular process with lumen; ICA, internal carotid artery; BA, basilar artery.



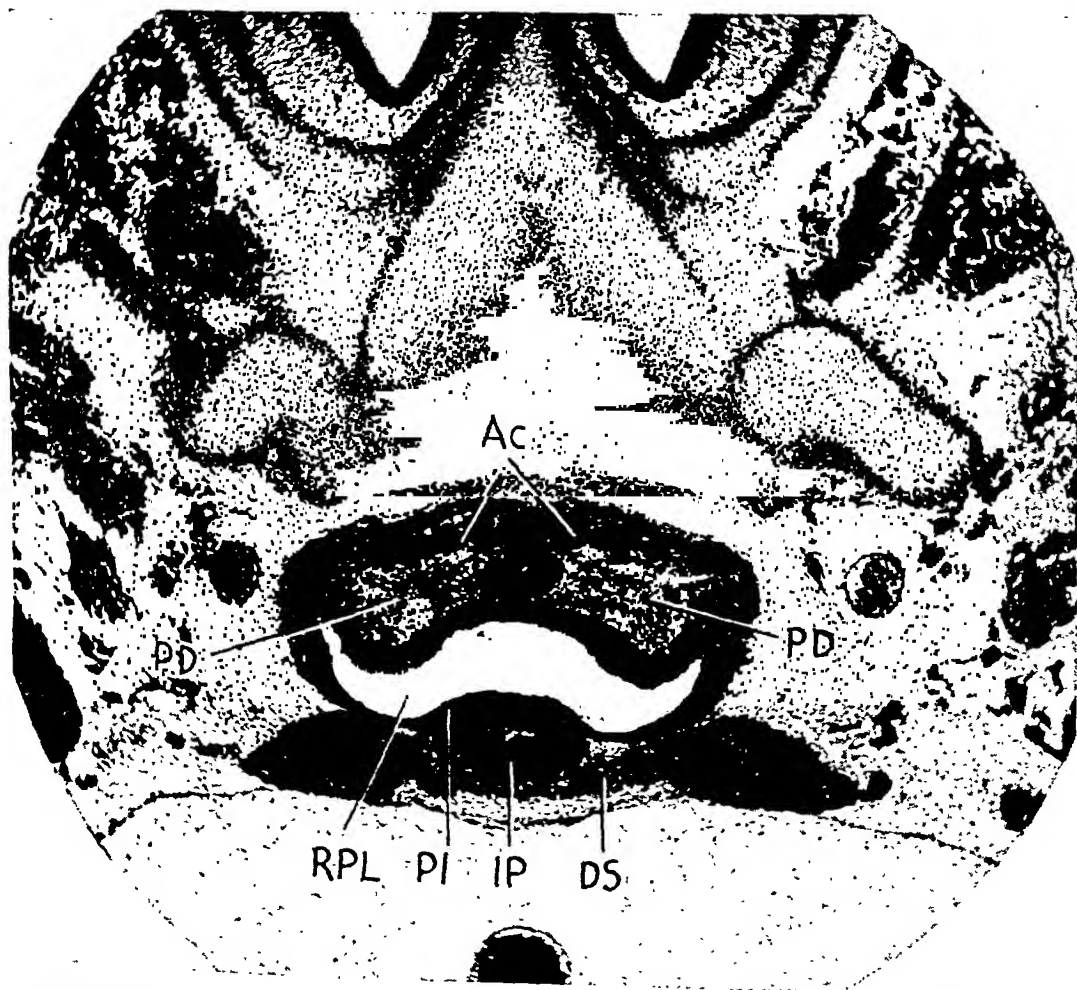


Fig. 27 (Haden). Higher magnification. Transverse section of 24 m.m. foetus at lower level than figure 26. Ac, acini connecting tuberal processes; PD, pars distalis (pars anterior propria); RPL, Rathke's pouch lumen; PI, pars intermedia; IP, infundibular process; DS, primordium of dorsum sella.



Fig. 28 (Haden). Higher magnification. Transverse section of half of head of a 29 m.m. foetus passing horizontally through the ON, optic nerve; fibers of nerve turn caudally when they reach the CP, chiasm primordium; chiasm is continuous with ME, median eminence of tuber cinereum which has a horizontally extended, MEC, cavity; ICA, internal carotid artery.

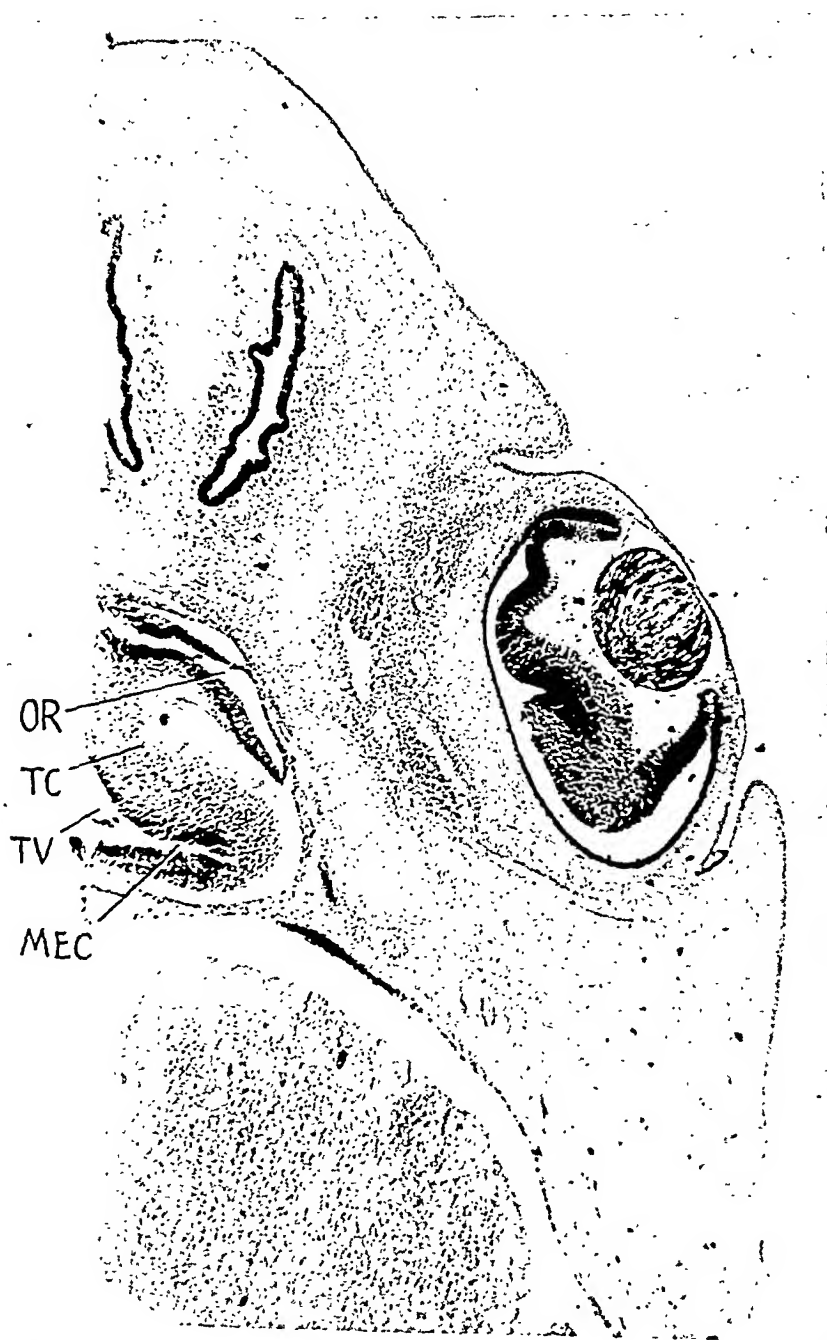


Fig. 29 (Haden). Low magnification. Transverse section of half of head of 29 m.m. foetus in same plane as figure 28 but above the level of optic nerve. OR, optic recess; TC, tuber cinereum; TV, third ventricle; MEC, median eminence cavity.

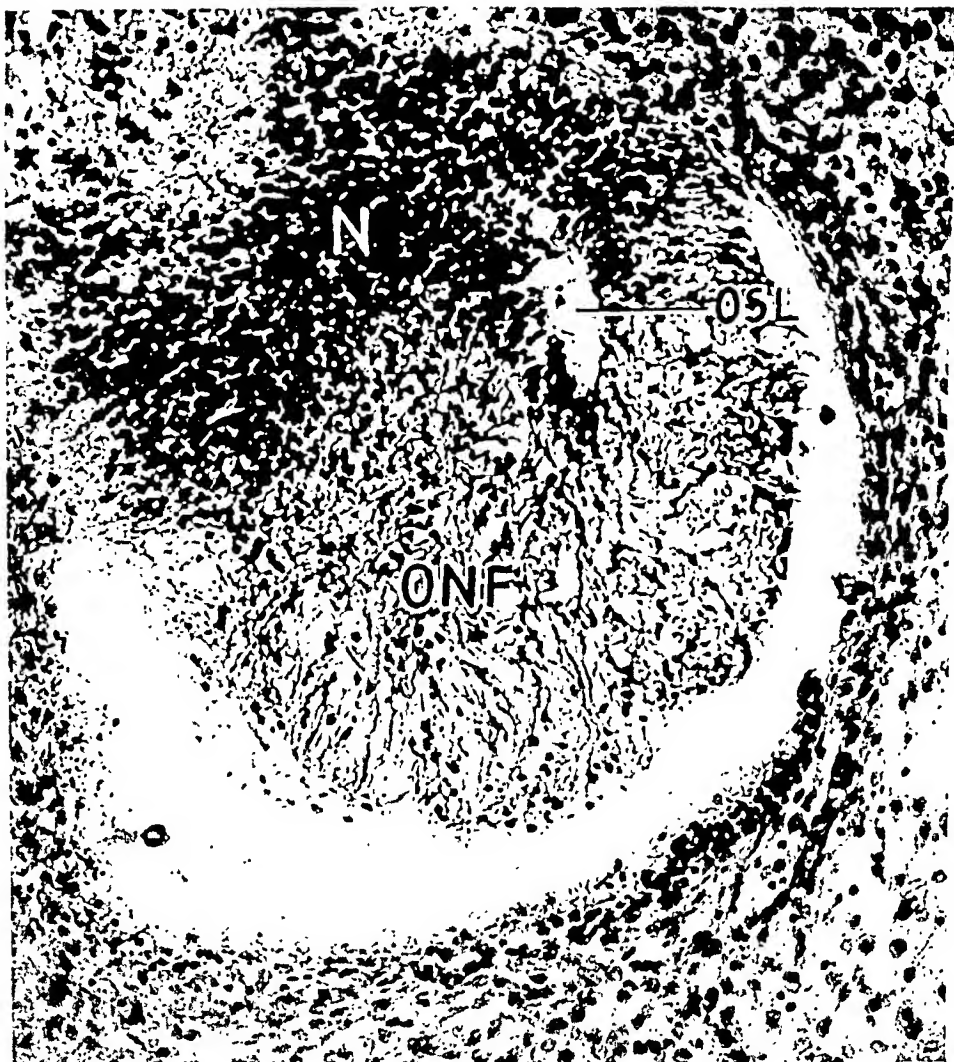


Fig. 30 (Haden). Higher magnification. Cross section of fellow nerve of 29 m.m. foetus within the cranium. N, nuclei; OSL, optic stalk lumen; ONF, optic nerve fibers.

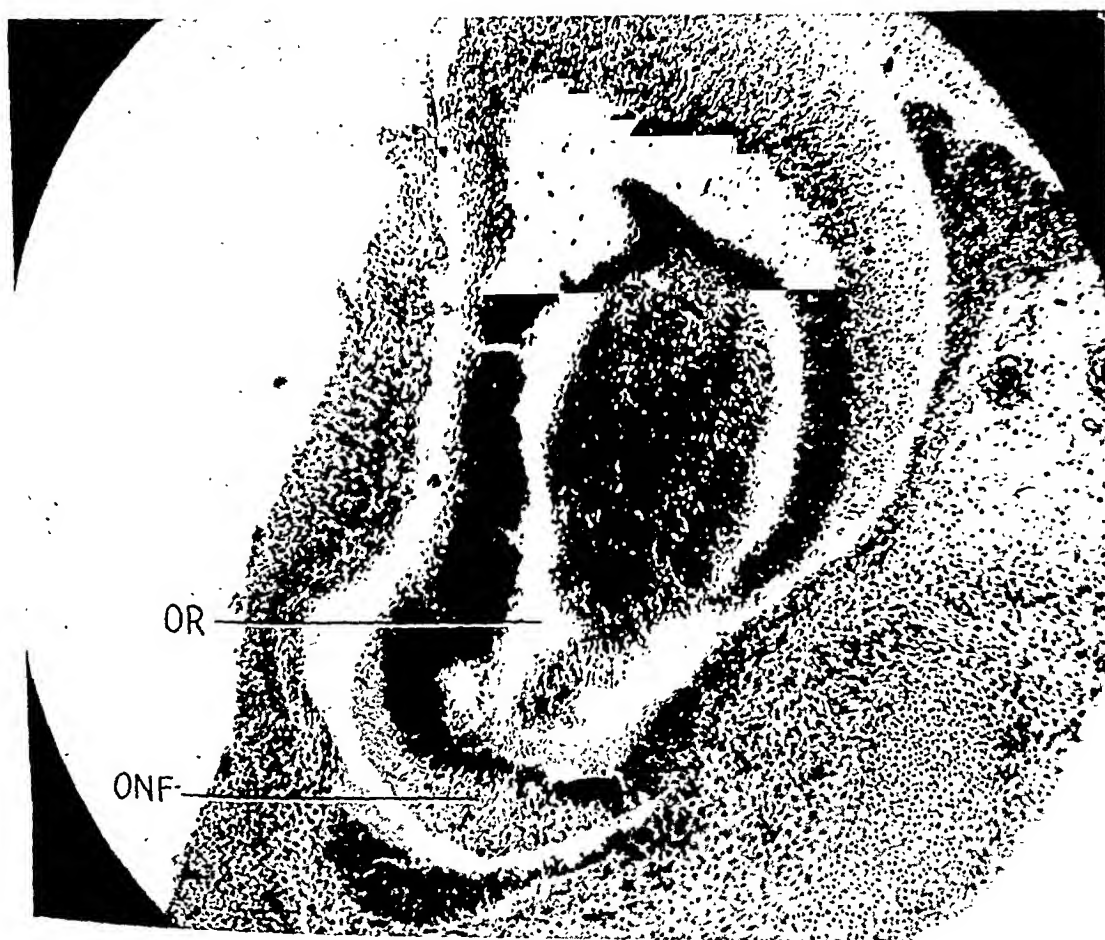


Fig. 31 (Haden). Higher magnification, 29 m.m. foetus. Cross section deeper in brain. Lumen of optic nerve goes into lumen of OR, optic recess; narrow zone of ONF, optic nerve fibers, below.

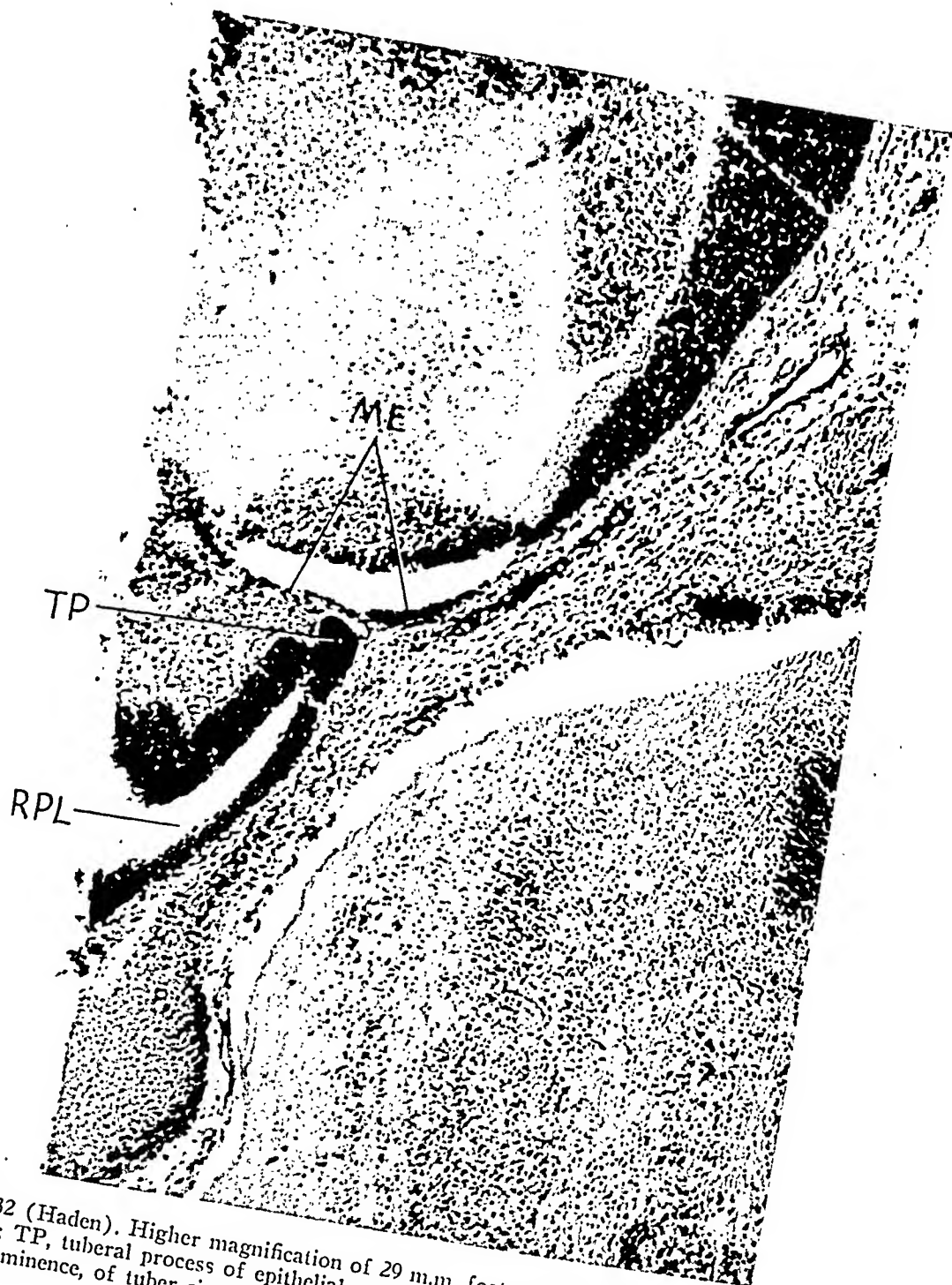


Fig. 32 (Haden). Higher magnification of 29 m.m. foetus. Cross section farther in brain; TP, tuberal process of epithelial portion of hypophysis reaching to ME, median eminence, of tuber cinereum; RPL, Rathke's pouch lumen.

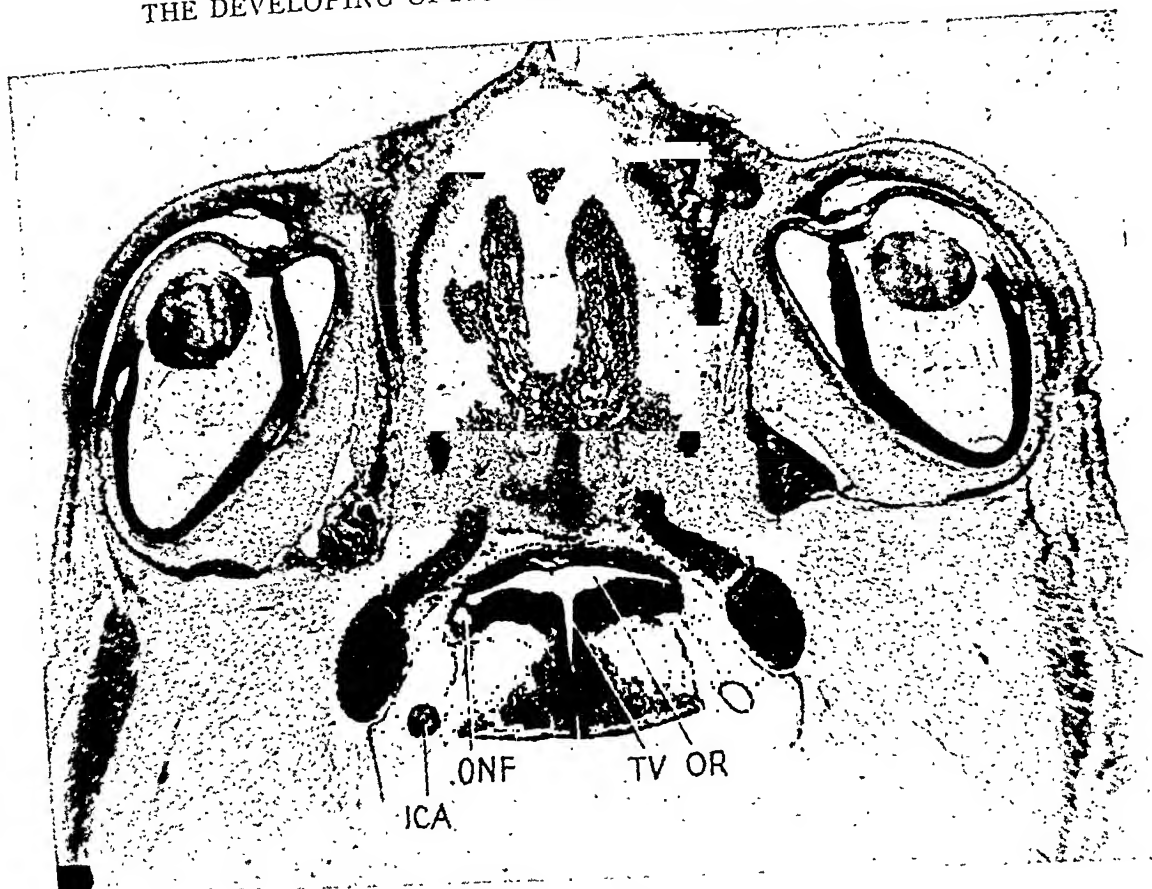


Fig. 33 (Haden). Transverse section of head of 40 m.m. foetus above level of optic nerve. OR, Optic recess communicates with TV, third ventricle, which is a narrow slitlike cavity whose walls are in contact in the middle portion; ONF, optic nerve fibers; ICA, internal carotid artery.

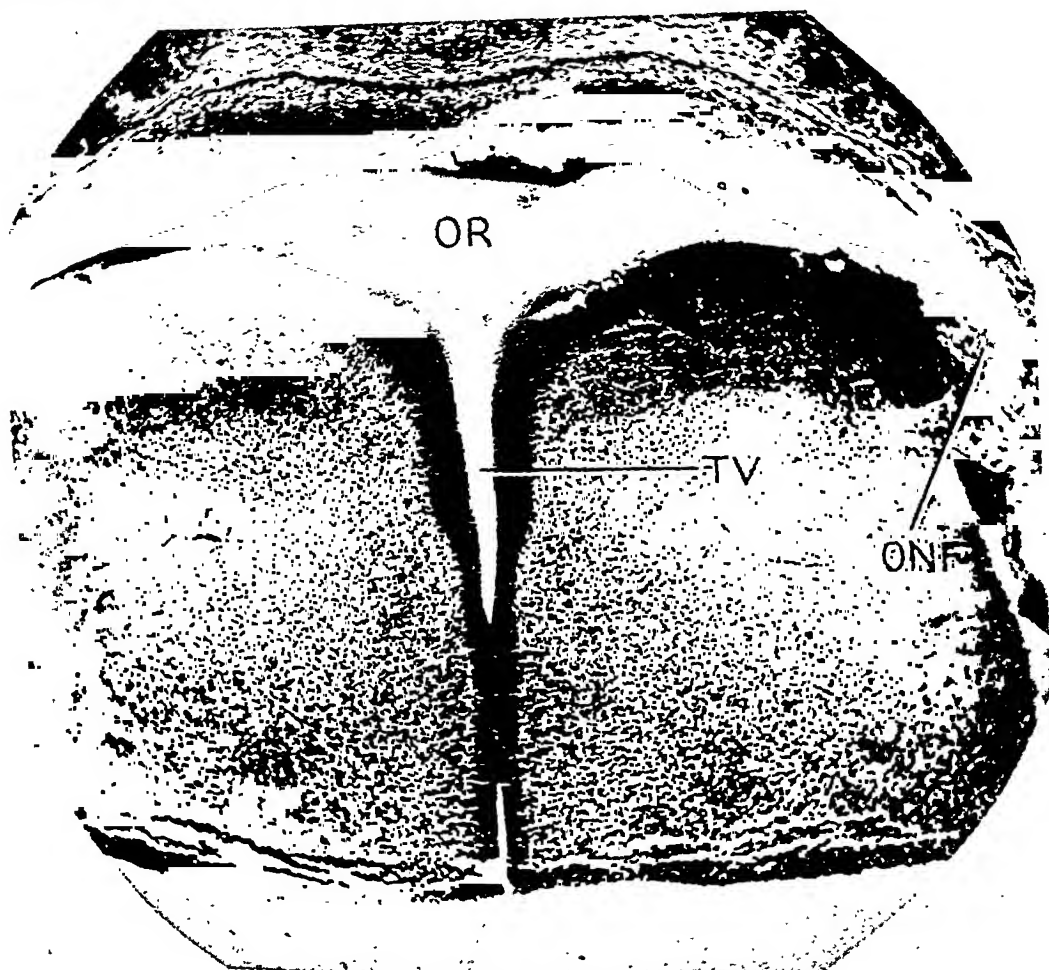


Fig. 34 (Haden). Higher magnification of figure 33. OR, optic recess; ONF, section of optic nerve; TV, third ventricle.



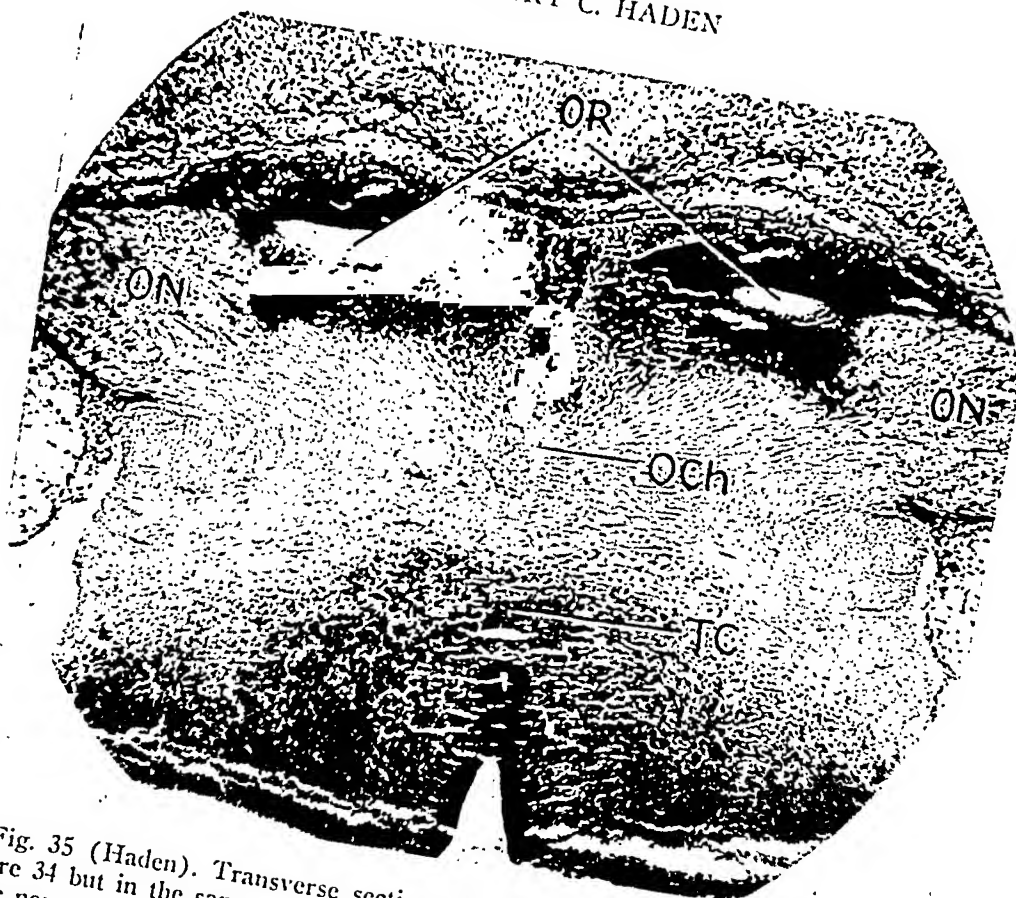


Fig. 35 (Haden). Transverse section of 40 m.m. foetus at a lower level than figure 34 but in the same plane. OR, lumen of optic recess, caudad to which ON, optic nerves, are seen entering OCh, optic chiasm; TC, tuber cinereum.

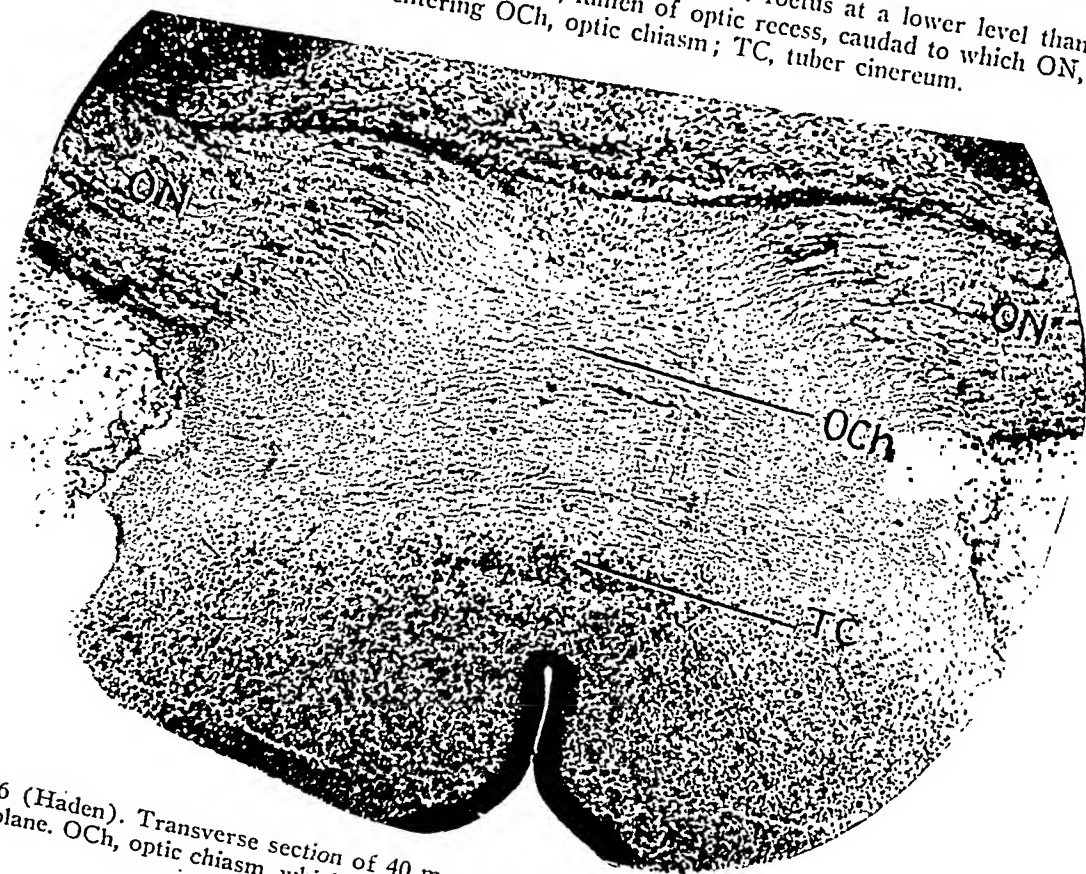


Fig. 36 (Haden). Transverse section of 40 m.m. foetus at lower level than figure 35 but in the same plane. OCh, optic chiasm, which is continuous with TC, tuber cinereum; ON, optic nerves.

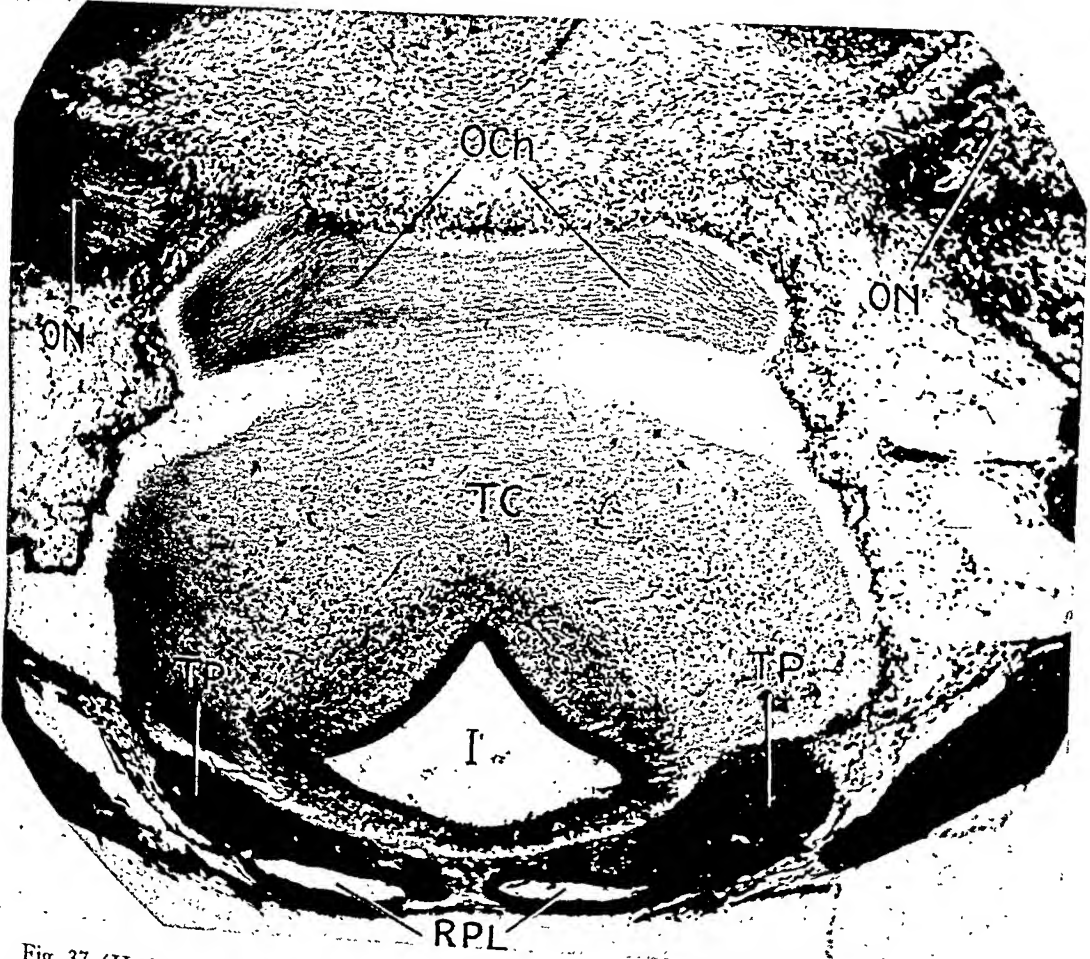


Fig. 37 (Haden). Higher magnification. Transverse section of 40 m.m. foetus at lower level than figure 36. ON, portion of optic nerves; OCh, lower part of optic chiasm; TC, tuber cinereum with opening in posterior portion leading into I, infundibulum; TP, tuberal processes of Rathke's pouch; RPL, Rathke's pouch lumen (note distance of infundibulum from chiasm).

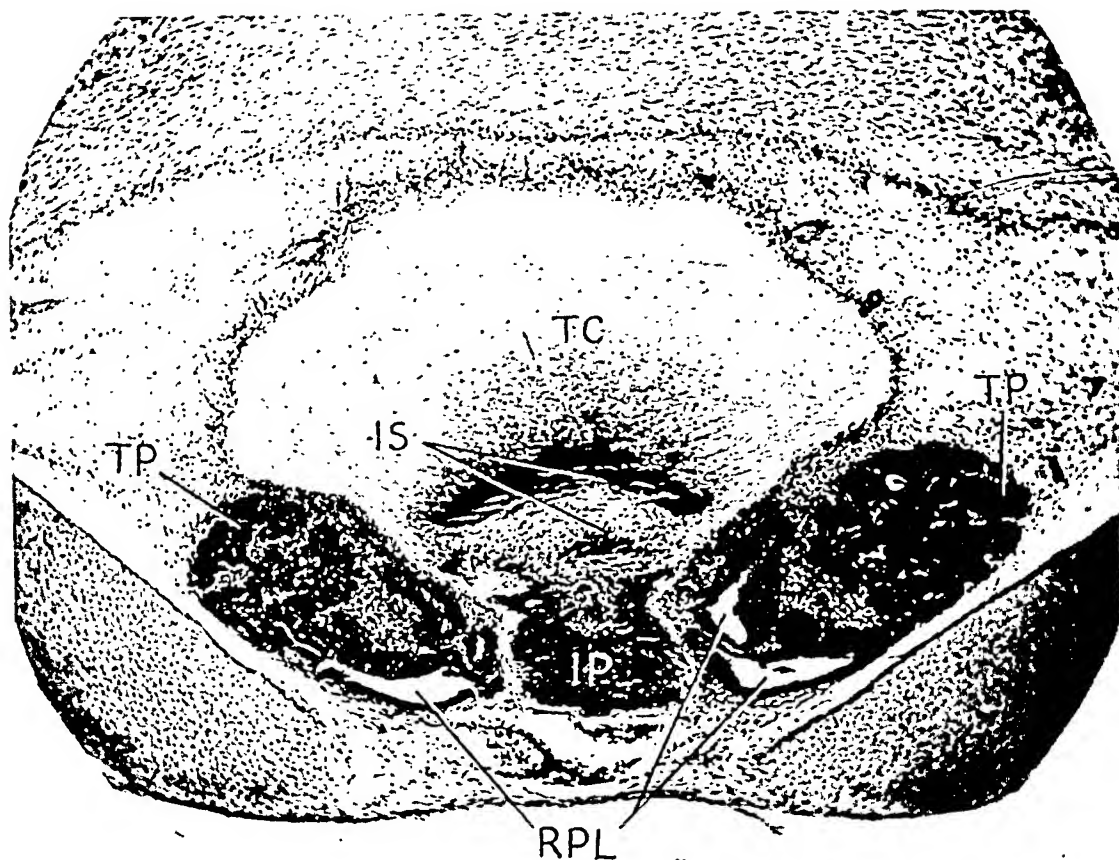


Fig. 38 (Haden). Higher magnification. Transverse section of 40 m.m. foetus at lower level than figure 37 but in the same plane. Section passes obliquely through the IS, infundibular stalk (stem), and IP, infundibular process; TP, tuberal process, filled with epithelial cells and mesenchyme; RPL, Rathke's pouch lumen; TC, tuber cinereum.

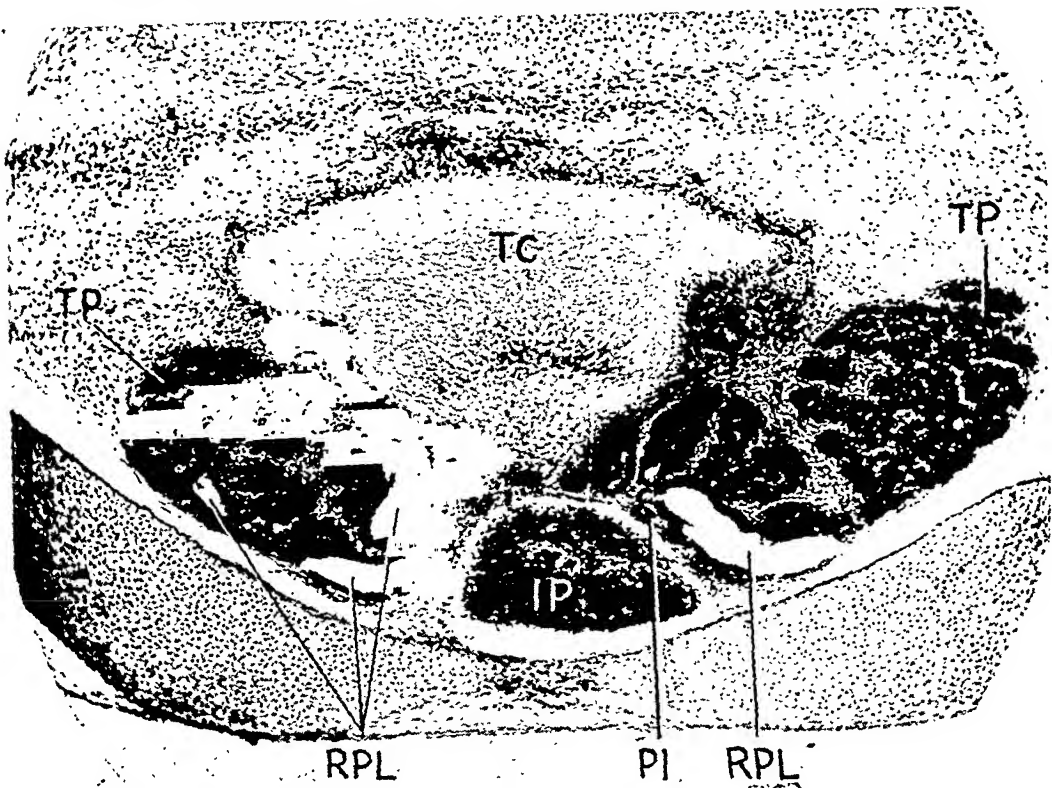


Fig. 39 (Haden). Transverse section of 40 m.m. foetus at a lower level than figure 38 but in the same plane, passing through TC, median eminence of tuber cinereum; TP, tuberal processes; RPL, Rathke's pouch lumen; PI, pars intermedia; IP, infundibular process.

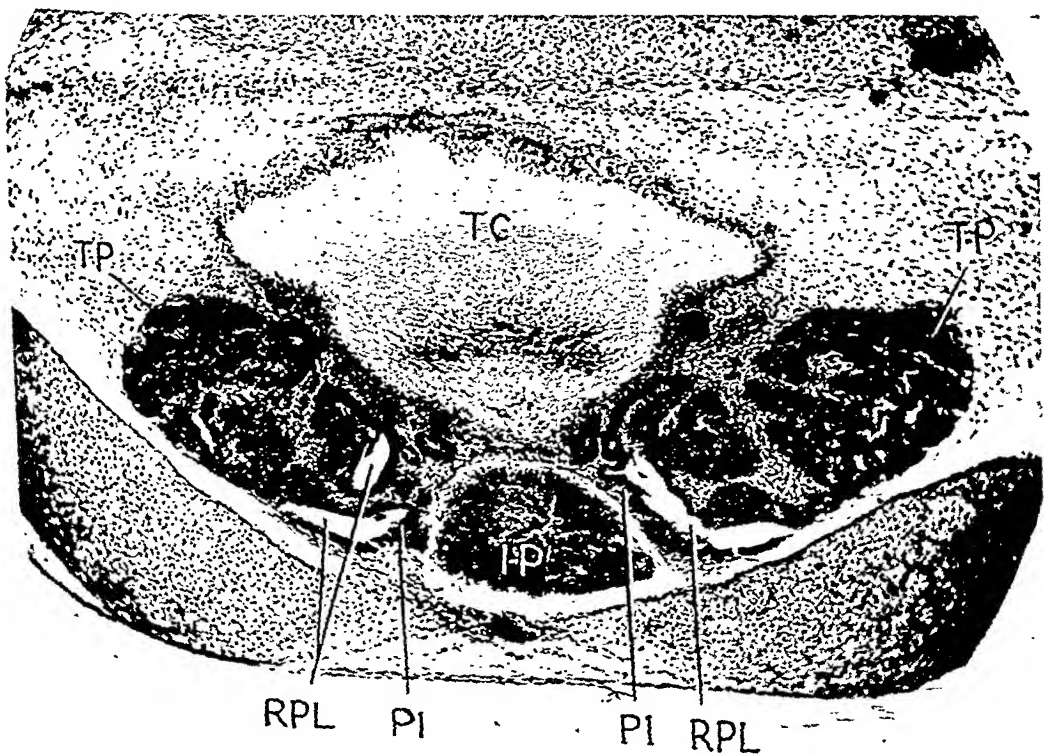


Fig. 40 (Haden). Transverse section of 40 m.m. foetus at a lower level than figure 39 but in the same plane. TC, median eminence of tuber cinereum; TP, tuberal processes; PI, pars intermedia; IP, infundibular process; RPL, Rathke's pouch lumen.

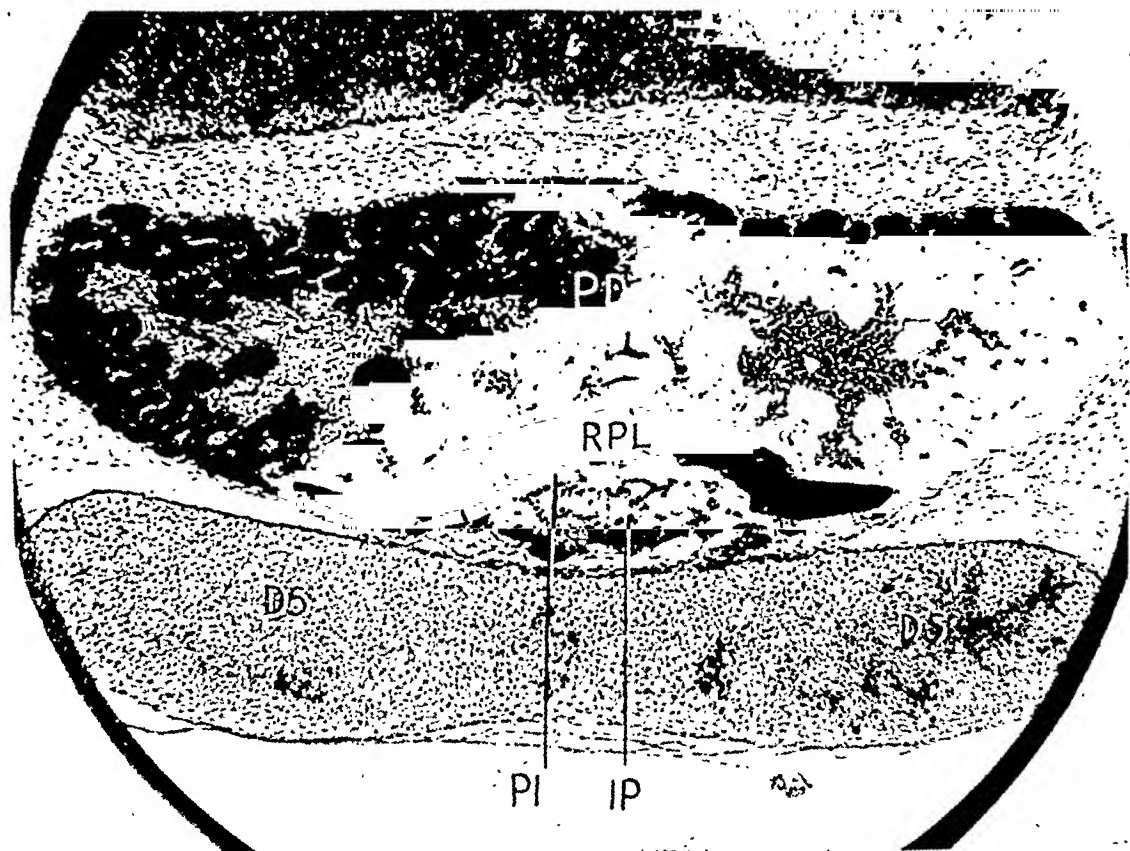
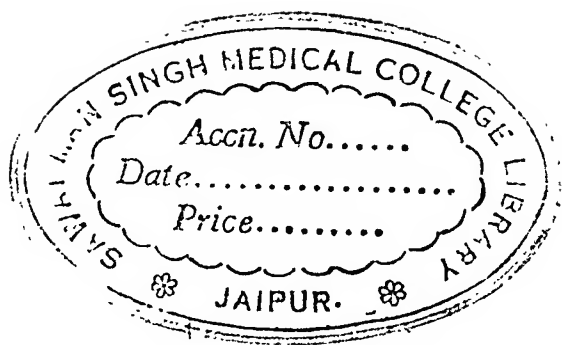


Fig. 41 (Haden). Transverse section of 40 mm. foetus at much lower level than figure 40 but in the same plane. PD, pars distalis (pars anterior propria); RPL, Rathke's pouch lumen; PI, pars intermedia (pars infundibularis), and IP, infundibular process lying in primordium of sella turcica; DS, dorsum sella primordium.







## DEEP-CHAMBER GLAUCOMA DUE TO THE FORMATION OF A CUTICULAR PRODUCT IN THE FILTRATION ANGLE

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In the majority of the cases of primary glaucoma there is a shallow anterior chamber. The pathologic change is posterior to the iris and probably in the ciliary body and/or the vitreous. In a much smaller number of cases there is a normally deep, or even an abnormally deep, anterior chamber. The pathologic change is in the trabecular region. The lesion is usually referred to as a sclerosis of the trabeculae, and it is concerning the nature of this condition that this paper deals.

## ANATOMY

The anterior chamber, as well as the interstices of the trabeculae at the filtration angle, is lined with endothelium. This endothelium is capable of producing a cuticular product or glass membrane as exemplified by Descemet's membrane. The endothelium retains its ability to produce the cuticular product throughout life, but does not manifest this potentiality except under certain provocations. For instance, as a sign of senescence, excrescences of Descemet's membrane are frequently produced in the peripheral area (Henle's warts); also, as a senile change, Descemet's membrane may become thicker. The excrescences and the thickening may occur in an aggravated form over

the entire membrane and produce the conditions of cornea guttata and dystrophica epithelialis corneae. After injury the endothelium of the cornea will regenerate a new Descemet's membrane. Under certain pathologic provocations the endothelium along the anterior surface of the iris may produce a membrane similar to, and even thicker than, the Descemet's membrane of the cornea (fig. 13).

The corneal endothelium, as well as some of its cuticular product, is continued normally from the cornea to cover the interstices of the trabeculae (fig. 1). The structure of a trabecula, therefore, is a central collagenous fibrous strand around which is the cuticular product as a thin glass membrane, and this, in turn, is covered by the endothelium (fig. 2). Under certain provocations the endothelium, which lines the trabecular spaces and covers the inner surface of the filtration angle, may form its cuticular product, which fills the interspaces and/or forms a Descemet's-like membrane along the inner surface of the angle. The formation of this cuticular product in the filtration angle may obstruct the outflow of aqueous and produce glaucoma. It is this thesis that the author wishes to support.

## PATHOLOGY

The pathology is based on the microscopic examination of 26 globes. All of these were thought to belong to the group described in this paper. There were 16

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Fig. 1 (Reese). Normal anatomy at the termination of Descemet's membrane and the anterior border of the trabeculae (Salzmann). C, corneal stroma; T, deep anterior extremity of the trabeculae; D, Descemet's membrane; w, warts; d, termination of Descemet's membrane; vG, anterior-border ring; en, endothelium; i, fiber of the uveal trabeculae.

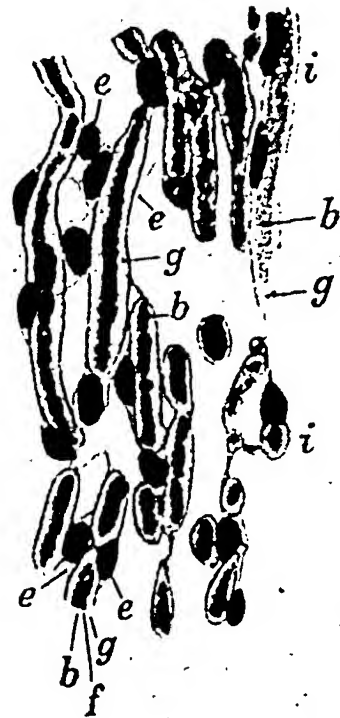


Fig. 2 (Reese). Normal anatomy of the trabeculae (Salzmann): i, uveal trabeculae. The remaining trabeculae belong to the scleral portion and show at: b, collagenous connective tissue; f, elastic fibers; g, glass membrane; e, endothelium.

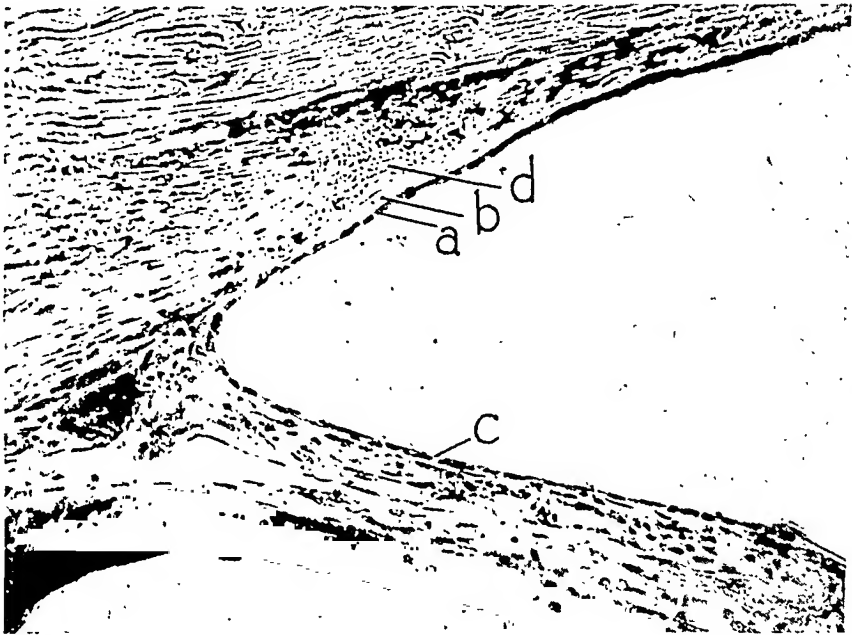
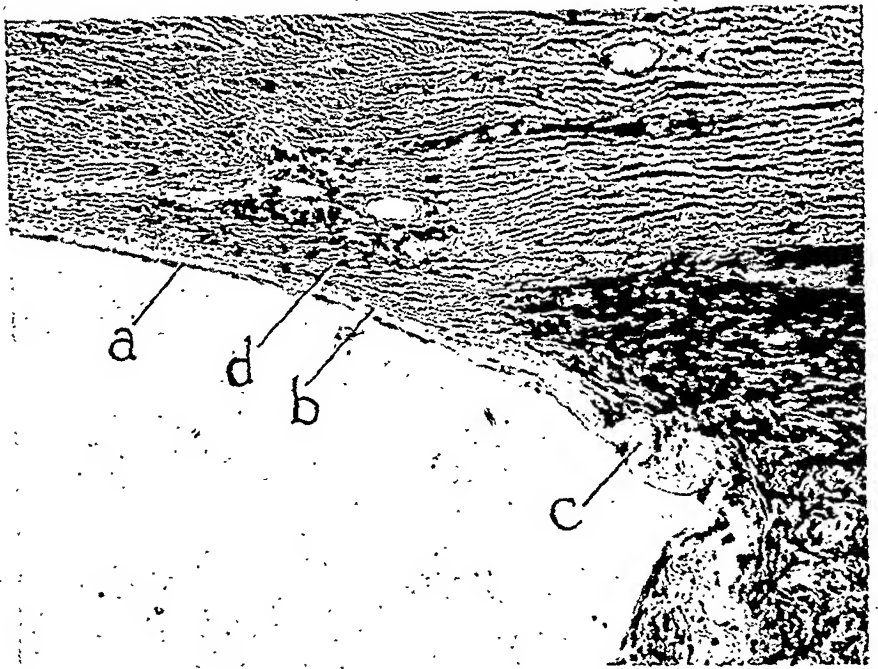


Fig. 3 (Reese). Deep-chamber glaucoma with open angle. Over the inner surface of the trabeculae the endothelial layer is seen (a), and under this a homogeneous glass membrane (b) which is continuous with Descemet's membrane. The endothelium and the glass membrane are continued, but the latter to a less degree, over the surface of the iris (c). The interstices of the trabeculae are decreased in size but still visible (d).

Fig. 4 (Reese). Deep-chamber glaucoma with open angle. Over the inner surface of the trabeculae the endothelial layer is seen (a), and under this a homogeneous glass membrane (b) which is continuous with Descemet's membrane. The glass membrane is particularly thick and also in folds over the inner surface of the ciliary body (c). The trabecular spaces seem somewhat compressed (d).

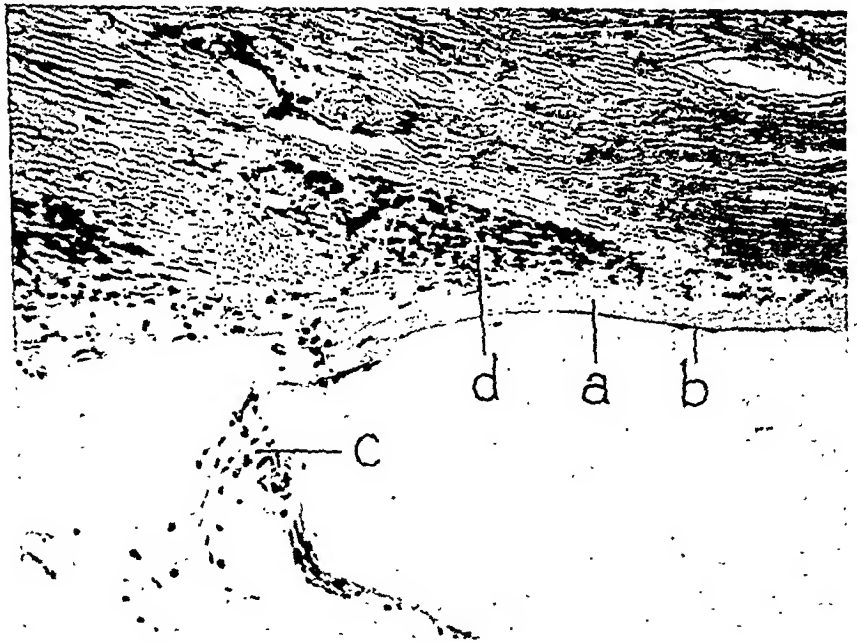


additional globes also with deep-chamber glaucoma and open filtration angle which did not belong to this group. The glaucoma in these cases was certainly due to impervious trabeculae, and pigment granules in the interstices were a conspicuous feature. They seem to represent instances of glaucoma due to obstruction of the trabeculae from sclerosis; but no effort has been made to determine the

underlying pathology except to note that impregnation of the trabeculae with pigment was an outstanding finding. These 16 cases were eliminated.

Even though the glaucoma discussed in this paper begins with an open filtration angle, if increased ocular pressure is present over a sufficiently protracted period, peripheral synechiae will develop (figs. 8, 11, 13). The mere state of in-

Fig. 5 (Reese). Deep-chamber glaucoma with open angle. The inner surface of the trabeculae is covered with a glass membrane (a) even thicker than Descemet's membrane with which it is continuous. Over the surface of the glass membrane is a thin layer of endothelial cells (b). Extending from the termination of the glass membrane across the angle to the anterior surface of the iris is an iris process (c). The trabecular spaces are collapsed (d).



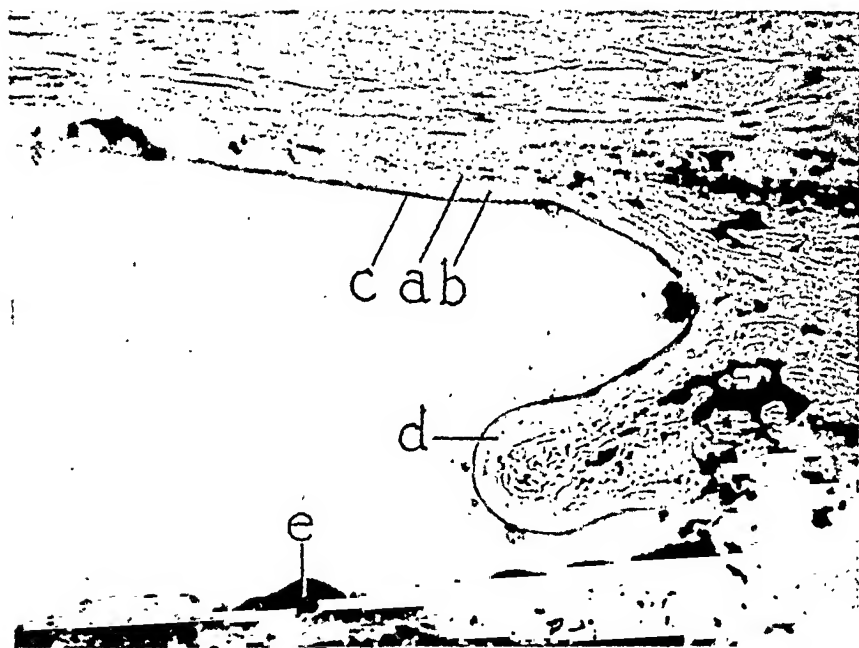


Fig. 6 (Reese). Deep-chamber glaucoma with open angle. The trabecular area is replaced by homogeneous tissue sparse in nuclei (a), and over its surface there is a glass membrane (b) and a layer of endothelium (c) continuous with those of the cornea. The glass membrane and endothelium are also continued over the angle where they are seen as a tall fold (d); e, anterior surface of the iris.

creased ocular pressure *per se*, from any type of glaucoma, tends to produce peripheral synechiae. Therefore, all glaucoma in the late stages, whether it began as a shallow- or deep-chamber type, will terminate with peripheral synechiae. In the later stages of the disease the pathologic change concerned, particularly around the filtration angle, is usually masked by secondary manifestations, and the picture merges into one more or less

similar for all primary glaucoma. In the terminal stages it is impossible, in many instances, to state from the microscopic sections what type of glaucoma initiated the process. Pathologic specimens obtained before the disease lost its entity are, therefore, most desirable and are the ones chosen for this study.

The pathologic change concerned is depicted in figures 3 to 8. These show the formation of the cuticular product

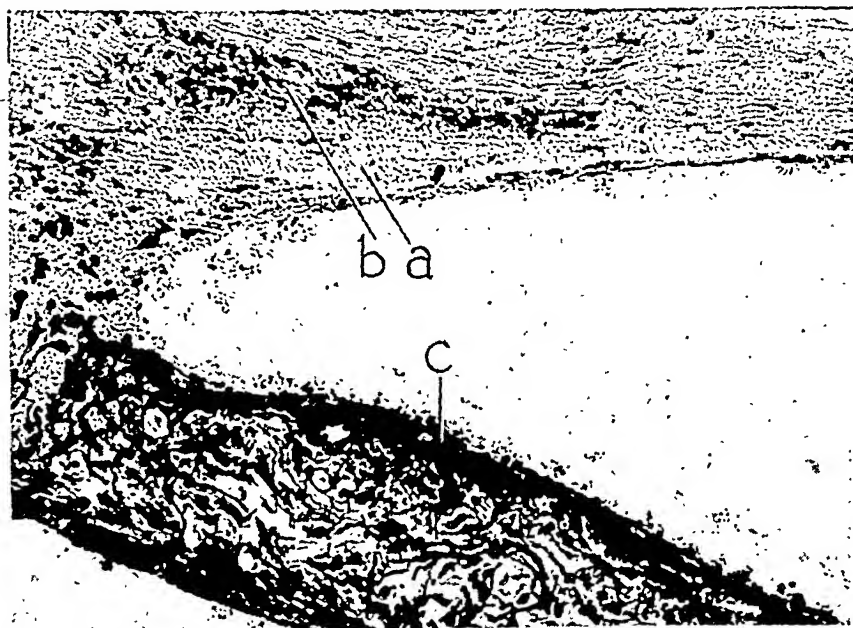
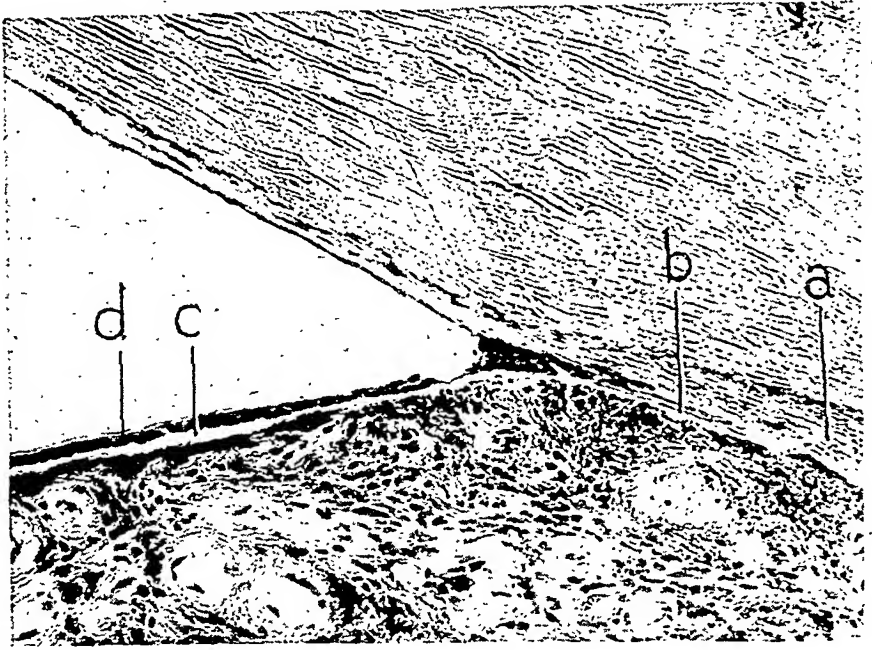


Fig. 7 (Reese). Deep-chamber glaucoma with open angle. The inner half of the trabecular area is replaced by a homogeneous hyaloid material (a) sparse in nuclei while the outer half still shows trabeculae with some pores (b). The iris (c) has some red blood cells along its anterior surface.

Fig. 8 (Reese). The angle is closed by a peripheral synechia. The trabecular area is replaced by a homogeneous hyaloid material (a). Between this and the iris stroma is a thin glass membrane (b) which continues on the anterior surface of the iris (c) and is covered by multiple layers of endothelium (d). This represents the opposite angle of the same eye to that shown in figure 3.



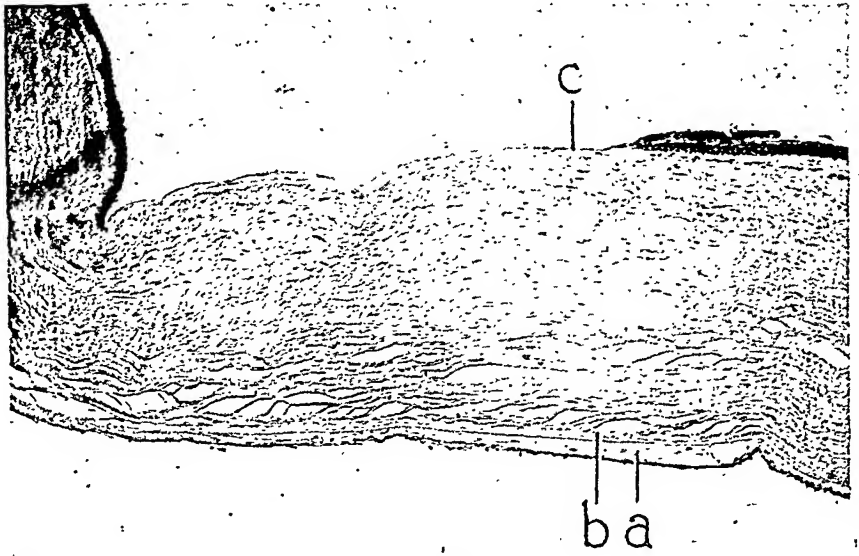
in the trabecular area and over the trabecular surface.

This cuticular product can be studied satisfactorily with the ordinary hematoxylin and eosin stains, but is better demonstrated by the Verhoeff elastic tissue, the Masson trichrome, and the Taenzer-Unna orcein stains.

Sometimes the cuticular product of the endothelium is laid down primarily in

the interstices of the trabeculae, even to the point of completely obliterating them (figs. 6, 7, 8, 11); and the tendency is for the inner lamellae to be affected more than the outer. The filling of the interstices of the trabeculae with the hyaloid material may be the sole cause of the trabecular obstruction, or it may be combined with the formation of a glass membrane or Descemet's-like membrane along

Fig. 9 (Reese). The cornea in a case of deep-chamber glaucoma due to the formation of a cuticular product in the filtration angle. There is a second Descemet's membrane of irregular thickness (a) superimposed on the regular Descemet's membrane (b). At its thickest portion the acquired membrane is several times thicker than the regular membrane. Endothelial cells are along the surface and an occasional one is seen throughout the second membrane. The external corneal surface (c) shows the epithelium missing in part at the site of a bulla.



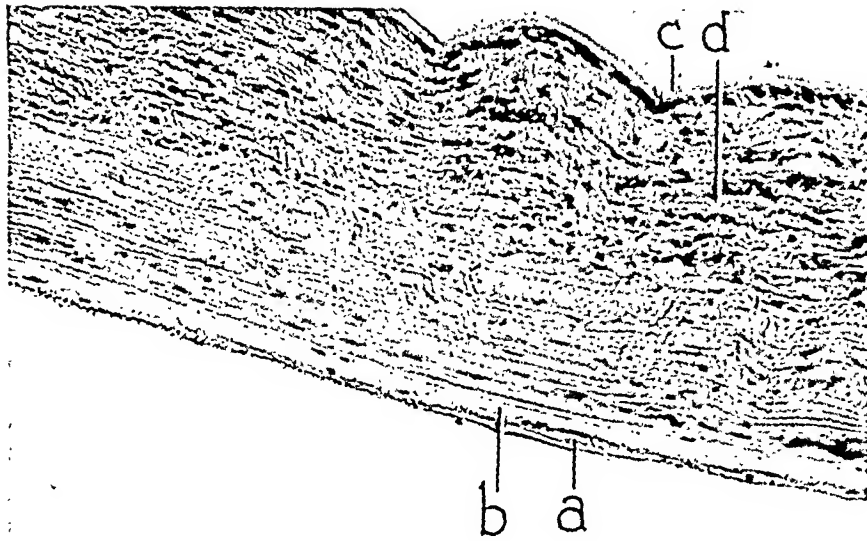


Fig. 10 (Reese). The cornea in a case of deep-chamber glaucoma due to the formation of a cuticular product in the filtration angle. There is a second Descemet's membrane of irregular thickness (a) superimposed on the regular Descemet's membrane (b). Endothelial cells are evident along the surface (c) and an occasional one is seen throughout the second membrane. The external corneal surface (c) shows the epithelium missing at the site of a bulla, and the underlying stroma shows infiltration with polymorphonuclear leukocytes (d).

the inner surface of the trabeculae (figs. 6, 8). Sometimes the Descemet's-like membrane along the inner surface of the trabeculae is solely responsible for the trabecular obstruction (figs. 3, 4, 5), and the trabeculae in these instances may be relatively normal in appearance except that the trabecular spaces are collapsed. The glass membrane over the trabecular surface is continuous with Descemet's

membrane of the cornea and frequently continuous with a similar membrane over the anterior surface of the iris (figs. 3, 8, 11, 13). Sometimes this hyaloid membrane will be folded in the angle between the trabecular area and the iris (figs. 4, 6).

It is common in these cases for the endothelium of the cornea to produce a reduplication of Descemet's membrane

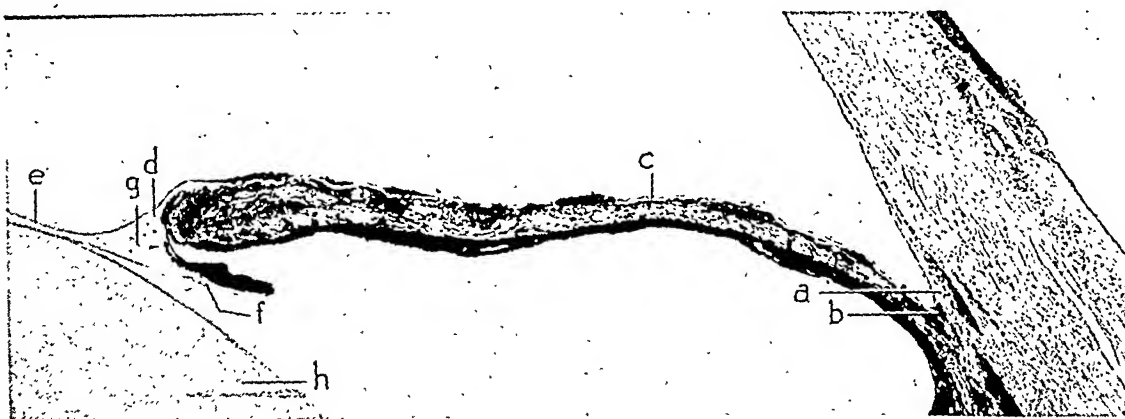


Fig. 11 (Reese). An advanced case of glaucoma due to the formation of a cuticular product in the filtration angle. The trabecular space is replaced by homogeneous hyaloid material (a) and over this peripheral synechiae have developed (b). The endothelium along the anterior surface of the iris has proliferated and formed a thin, irregular glass membrane (c). This endothelium and glass membrane are continued around the pupillary margin (d), over the anterior surface of the lens (e), and for a short distance back of the iris (f). At one site quite a thick layer of hyaloid material has been formed (g). The lens is shown at (h).



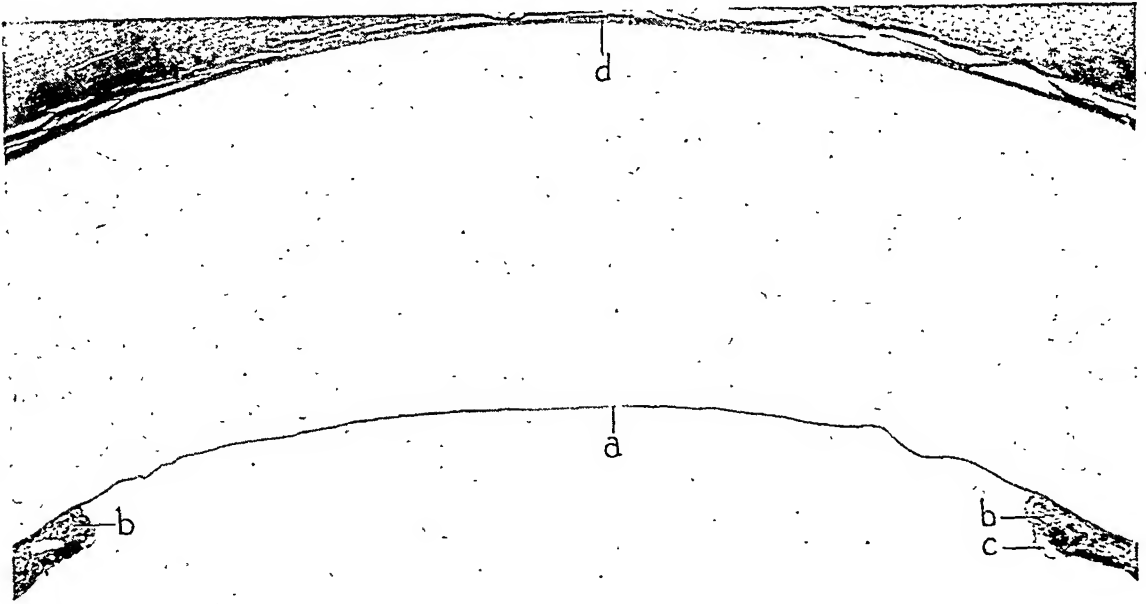


Fig. 12A (Reese). A case of glaucoma due to the formation of a cuticular product in the filtration angle. A glass membrane (a) extends across the pupillary area from one pupillary margin of the iris to the other (b, b). There are several endothelial nuclei along the anterior surface of the membrane which is continuous with a similar but less demarcated membrane along the anterior surface of the iris. Some of the cuticular product is also seen around the pupillary margin (c). There was a hypermature cataract which had become spontaneously subluxated. The cornea is shown at (d).

superimposed on the regular membrane (figs. 9, 10). The acquired membrane varies in thickness and is less homogeneous than the regular membrane. In places it may be several times thicker than the regular membrane and show endothelial nuclei scattered throughout its substance.

The corneal epithelium is edematous, elevated from the underlying Bowman's membrane, of irregular thickness, and frequently composed of several layers (fig. 9). Sometimes the epithelium is missing entirely, owing to a ruptured bulla (fig. 10), or a frank ulcer with infiltration of the underlying

stroma by polymorphonuclear leukocytes (fig. 10).

Not only can the endothelium produce this hyaloid material at sites where it is

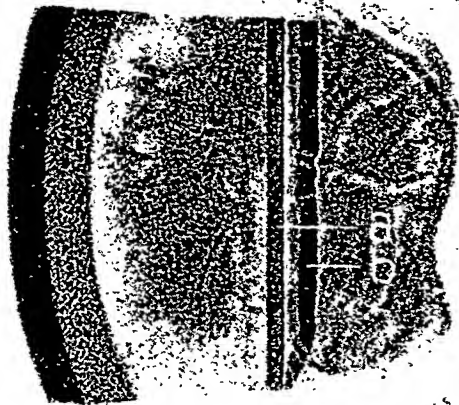


Fig. 12B (Reese). A slitlamp drawing showing the glass membrane in figure 12A. The transparent membrane (a) is seen crossing the pupillary area with the subluxated lens (b) posterior to it.



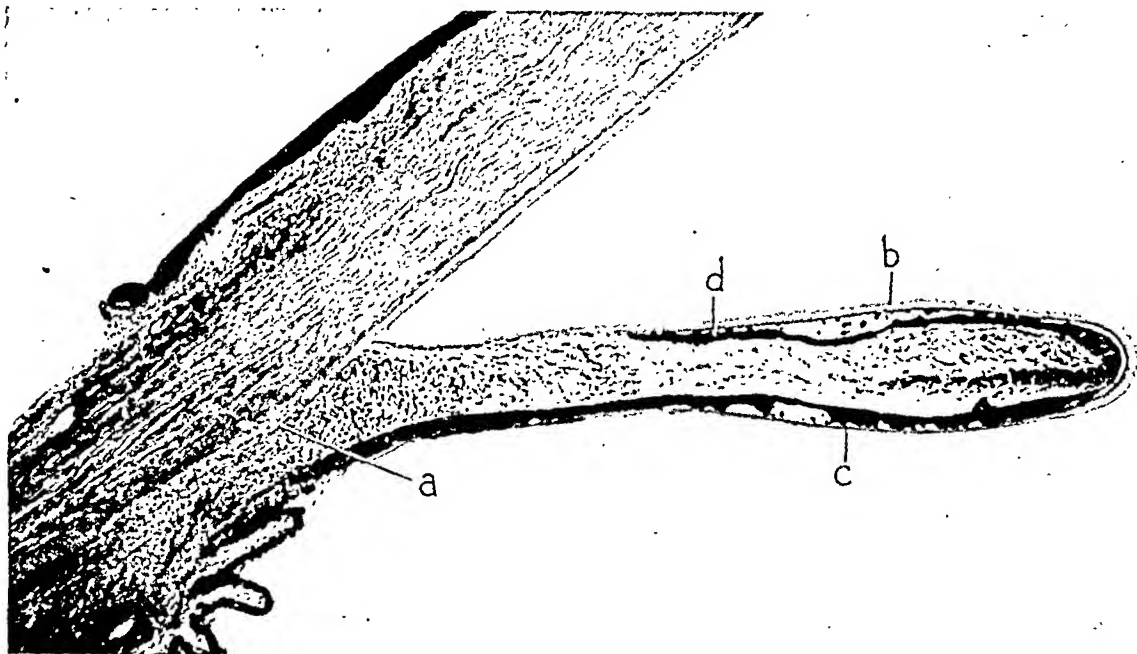
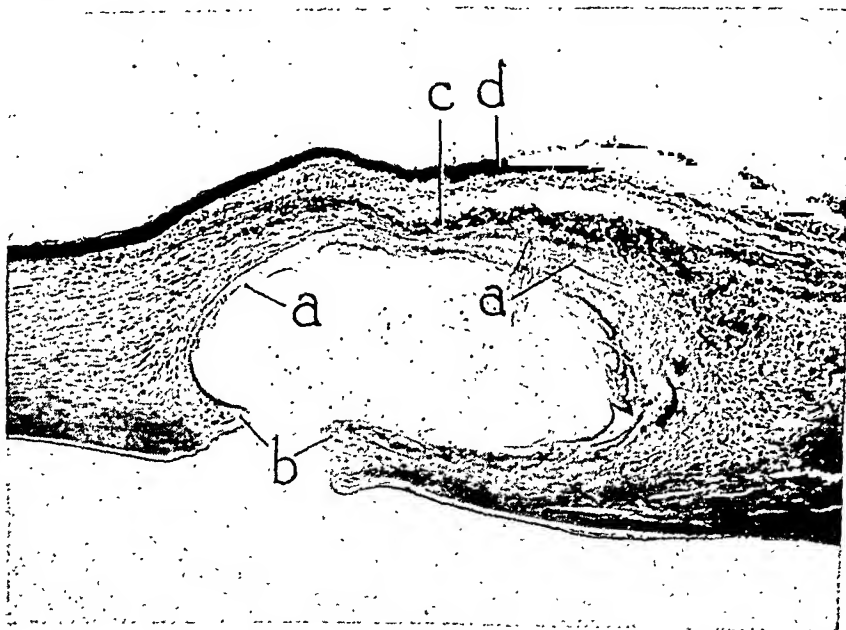


Fig. 13 (Reese). An advanced case of glaucoma due to the formation of a cuticular product in the filtration angle. There is a broad peripheral synechia (a). The entire anterior and posterior surfaces of the iris are covered with a glass membrane (b, c) which in places is thicker than Descemet's membrane. There is an ectropion uvea (d).

normally found, but it has the ability under provocation to grow over surfaces where it is not normally found and produce a glass membrane. It may grow across the pupillary area (figs. 11, 12A, B), over the anterior capsule of the lens, and along the posterior surface of the iris (fig. 13). If a trephine operation is per-

formed on this type of case the endothelium may grow into the trephine opening and produce hyaloid material which partially fills the trephine opening and prevents filtration (fig. 14). This occurred in the four instances in which this operation was done.

Fig. 14 (Reese). The site of a trephining operation performed on an eye with deep-chamber glaucoma due to the formation of a cuticular product in the filtration angle. The trephine opening is lined with a hyaloid cuticular product (a, a). This forms a definite glass membrane around the opening into the anterior chamber (b); the membrane is continuous with Descemet's membrane. c, represents a thin fibrous layer, and d, the conjunctiva.



## CLINICAL CHARACTERISTICS AND CORRELATION WITH MICROSCOPIC FINDINGS

Half of the 26 cases were thought clinically to be instances of primary glaucoma. The others were either diagnosed as secondary glaucoma, or the clinical records implied that secondary glaucoma was suspected. The clinical evidence, however, was mainly an inflammation of the eye which, in most instances, could have been secondary to the corneal lesion. The microscopic examination of the eyes showed actual endogenous uveitis in only six cases, and one of these was thought to be tuberculous. In one case, the condition was thought to be glaucoma secondary to occlusion of the central retinal vein. A history of trauma to the eye was regarded as a significant factor in six cases. Sixteen of the cases showed involvement of only one eye with no evidence of glaucoma mentioned in the fellow eye.

The corneal lesions were a most constant and conspicuous feature of the clinical and microscopic pictures. The condition of the cornea was mentioned clinically in all cases but two. The typical lesion was a cloudiness of the stroma and epithelium with a tendency to the formation of vesicles and bullae. These would rupture repeatedly until finally an ulcer developed. With the rupture of the epithelium and the formation of the ulcer, the inflammatory reaction of the eye became a prominent feature. Wrinkling of Descemet's membrane and insensitivity of the cornea were mentioned, and in one instance a comment was made to the effect that the condition resembled in every way dystrophia epithelialis corneae. The corneal process usually began in the central, or lower central, area. In the pathology reports of our cases the corneal changes were noted in 20 cases as ulcer, keratitis, or marked pannus.

Atrophy of the iris was a fairly common occurrence. Clinically, this ranged

from rarefaction of the stroma to actual disappearance of the stroma at sites. In one case the diagnosis of essential atrophy was made due to the entire disappearance of the iris stroma in one sector. The clinical records mentioned atrophy of the iris in 10 cases and, as a result of this, corectopia was noted in three. In the microscopic reports, iris atrophy was mentioned in eight cases.

Spontaneous hyphema was mentioned in six of the clinical records while in the pathology reports, choroidal hemorrhage was noted in three instances, hemorrhophthalmos in two instances. The not infrequent occurrence of hemorrhage suggests the possibility that the endothelium of the blood vessels, as well as that of the anterior chamber, may be affected.

The general diseases mentioned in the clinical records were arteriosclerosis in eight, syphilis in two, high blood pressure in six, diabetes in one, Parkinsonian disease in one, and spastic paraplegia in one. A history of iritis was noted in two.

Excluding the cases in which there was definite trauma, the average age was 50 years. The ages ranged from 31 to 80 years. Twenty-three of the cases affected the white race and three the Negro race.

Trephine operations to relieve the intraocular pressure were done in four cases, and they were all ineffective. It is surprising that more operations were not attempted to relieve the intraocular pressure in this group of cases. The reason may be that the corneal lesion became prominent in the relatively early stage of the disease, led to much discomfort, and precluded further useful vision, so that enucleation was performed instead. The trephine operations were unsuccessful because the endothelium grew into the trephine opening and produced the hyaloid material which prevented filtration (fig. 14).

The clinical records show that miotics

were without effect. This is to be expected from the very nature of the lesion of the filtration angle.

The microscopic examination of these eyes revealed no tendency to excrescences of the lamina vitrea.

Cornea guttata was not mentioned in the fellow eye on the clinical records. In one case there was described a lesion of the cornea in the fellow eye and this could have been dystrophia epithelialis corneae.

There is very little that can be said regarding the examination of these eyes with the gonioscope. The corneal condition often prevented a view of the angle. On the record of one case there was a notation by Troncoso to the effect that the angle of the fellow eye was filled with what seemed to be an exudate. The cornea of this eye showed changes simulating dystrophia epithelialis corneae.

#### LITERATURE PERTINENT TO THE SUBJECT

The fact that glaucoma is caused by sclerosis of the trabeculae is generally accepted, but, in reviewing the literature, one finds surprisingly little on this subject. What is meant by sclerosis of the trabeculae, its histologic picture, and its cause is hardly mentioned. Henderson,<sup>1</sup> in discussing the anatomic factors bearing on the pathogenesis of primary glaucoma, gave two: (1) a physiologic sclerosis of the cribriform ligament which was constant, and (2) a vascular factor which was variable. He claimed<sup>2</sup> that the cribriform ligament undergoes throughout life a progressive and physiologic sclerosis so that, starting as a cellular structure at birth, it becomes a purely fibrous formation in old age. The anatomic result of the sclerosis is to reduce greatly the interspaces and alveoli of the retiform structure and thus seriously impede the ready access of the aqueous to Schlemm's canal. He believed that the sclerosis is induced

by the constant traction of the ciliary muscle on its ligament of attachment. The vascular factor, he thought, is vasomotor in nature and is the precipitating factor in an eye predisposed by the aforementioned sclerosis. Other precipitating factors mentioned were dilatation of the pupil, closure of the iris crypts, rise in arterial pressure, rise in venous pressure, and swelling of the lens.

Herbert<sup>3</sup> did not consider Henderson's deductions on the role of sclerosis of the pectinate ligament as a cause of glaucoma to be justifiable.

Priestley-Smith<sup>4</sup> felt that the theory of a primary sclerosis of the trabeculae was insufficient.

Verhoeff<sup>5</sup> concluded that sclerosis of the trabeculae is not a cause of glaucoma but a result of peripheral synechiae. This is based mostly on sections in which the iris appeared to be retracting from the trabecular surface, indicating that the synechiae had once been complete. The changes in the trabeculae were mostly along the surface and consisted in acquired tissue with more or less obliterated interstices of the trabeculae. The new-formed tissue consisted of vascularized connective tissue, of hyalin, or elastic tissue, and, in one case, of tissue similar to that composing the iris stroma. He thought these changes were produced in the following way: During the persistence of the adhesions of the iris root to the trabeculae, the opening of the alveolar spaces into the anterior chamber became permanently obliterated by cell proliferation. If the iris pulled away early, a comparatively smooth surface remained. If the iris pulled away late, more or less of the tissue from the iris was left adherent to the trabecular surface. Over this surface, corneal endothelium grew and sometimes a hyalin layer formed, or even an elastic membrane identical to, and continuous with, Descemet's mem-

brane. He discussed the mechanism by which the separation of the synechiae from the trabecular surface might take place. In a later paper Verhoeff<sup>6</sup> stated, "in the absence of such synechiae obstruction to the outflow from the eye may no doubt exceptionally result from changes within the ligament itself."

Lamb<sup>7</sup> stated that sclerosis of the trabeculae was due to the formation of connective tissue from toxins of unknown origin.

Barkan, Boyle, and Maisler<sup>8</sup> felt that sclerosis of the trabeculae and pigment deposit in their interstices are a frequent, if not constant, finding in primary glaucoma.

In Raeder's<sup>9</sup> opinion a primary closure of the outflow of aqueous at the angle in the form of sclerosis of the trabeculae is often found.

Elschnig<sup>10</sup> stated that in deep-chamber glaucoma the trabeculae are usually more or less thickened and sclerosed.

Rones<sup>11</sup> stated that "with advancing years the fibers of the ligament become thicker and sclerosed. Pigment granules originating from the epithelium of the iris and ciliary body become enmeshed in the fibers and at times the accumulation of pigment is quite considerable. The thickened and pigmented pectinate ligament undoubtedly loses efficiency as a filtration mechanism, but as to whether this plays a role in the etiology of glaucoma simplex, as has been suggested, is difficult to say."

McLean<sup>12</sup> felt that sclerosis of the trabeculae could not be identified with the gonioscope. In the discussion of this paper Troncoso concurred.

#### REFERENCES IN THE LITERATURE WHICH SUPPORT THE THESIS

Henderson<sup>1</sup> noted that at birth the cribiform ligament is purely a cellular structure of regularly arranged strands of

spindle-shaped cells. Before long, however, the individual columns of cells developed around their respective centers, by a process of secretion or excretion, a homogeneous substance similar to that composing Descemet's membrane. With each advancing decade more and more homogeneous material is laid down by the covering cells.

De Vries<sup>13</sup> described the histologic findings in a glaucomatous eye in which the anterior chamber was of normal depth. The trabeculae were sclerosed and the interspaces replaced by a structureless homogeneous substance in which there were a few endothelial nuclei. Over the surface of the filtration angle there was a new-formed glass membrane. He thought the sclerosis was the result of irritating material or toxins passing through the trabeculae and affecting the endothelial cells.

Tartuferi<sup>14</sup> examined microscopically a case of chronic glaucoma with wide-open filtration angle in which the trabecular area showed a homogeneous structure with no interstices and only an occasional endothelial nucleus. Clinically, the eye showed a cloudiness of the central part of the cornea due to edema, while the peripheral portion was clearer.

Sarti<sup>15</sup> reported a similar case in which the trabecular region was replaced by a homogeneous tissue with no interspaces. Clinically, this eye also showed marked corneal changes described as a bulla which ruptured repeatedly and, because of pain, led to enucleation.

Polya<sup>16</sup> also described a case with the same type of pathologic change. The filtration angle was wide open and the interstices of the trabeculae, as well as the trabeculae, were replaced by a homogeneous structure. A Descemet's-like membrane covered with endothelium extended over the inner surface of the angle and coursed over the anterior surface of

the iris. Clinically, there was a corneal opacity which abraded from time to time, causing pain and a marked inflammation of the eye.

Greeves<sup>17</sup> described the pathologic findings in a deep-chambered glaucomatous eye in which the inner lamellae of the trabeculae were replaced by a homogeneous tissue poor in nuclei and the inner surface of the trabeculae was covered with a homogeneous membrane continuous with and similar to Descemet's membrane.

De Vries's<sup>13</sup> explanation of the cause of the so-called sclerosis of the trabeculae is that irritating substances leave the eye through the filtration system of the angle and exert a deleterious effect upon the endothelium, causing the trabecular surfaces usually lined by endothelium to adhere and thereby close the angle to the passage of aqueous. The same noxious factors may cause endothelial changes in the anterior chamber. If these toxic or irritating substances are less than lethal to the endothelium, they may produce an irritating effect on the endothelium, thus causing it to grow. In this way De Vries explains the growth of the endothelium and its formation of a Descemet's-like membrane around the filtration angle and over the anterior surface of the iris.

This theory of De Vries is not unlike the contention of Fortin,<sup>18</sup> that the passage of aqueous through the endothelium-lined spaces of the trabeculae and Schlemm's canal is comparable to the situation in the kidney. He claims that the endothelial cells of the filtering system of the eye can suffer from acute or

chronic diseases just as the cells of the glomeruli of the kidney can, and that sclerosis of the trabeculae, and thus glaucoma, may be a sequela.

### SUMMARY

The endothelium of the anterior chamber may form a cuticular product at any site where it is normally found. It may also grow and produce this product over sites where it is not normally found; such as, over the trabeculae, across the pupillary area, or along the posterior surface of the iris. When this cuticular product is formed over the inner surface of the trabeculae or in the interstices of the trabeculae, glaucoma may ensue. This may occur as a primary disease with no apparent provocation. It also may occur as a result of inflammation in the anterior chamber, or as the result of trauma to the eye. The endothelial changes occur on the posterior surface of the cornea and permit aqueous to enter the corneal stroma. This gives rise to edema and its sequelae, such as vesicles, bullae, pannus, keratitis, and ulcer. The increased intraocular pressure intensifies these corneal changes. The underlying pathologic change and clinical picture are similar to dystrophia epithelialis corneae on the one hand, and the corneal changes consequent to glaucoma on the other hand, except that in this condition both factors are present and therefore the cornea may dominate the clinical picture.

I wish to express my appreciation of the assistance rendered by Miss Lilly Kneiske.

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# PENICILLIN THERAPY IN OCULAR INFECTIONS\*†

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With the employment of penicillin in the past year a significant advance was made in the chemotherapy of ocular infections. Penicillin is superior to sulfonamides in that it is effective in the presence of pus, secretion, and large numbers of organisms, and, so far as is known, does not inhibit the growth of corneal epithelial cells nor promote vascularization and scarring of the cornea. Encouraging clinical reports have already appeared, indicating that acute and chronic pyogenic infections of the eyeball and the surrounding soft tissues can be successfully treated by the local and general administration of penicillin: Abraham et al.<sup>1</sup> secured gratifying results from penicillin in acute and chronic conjunctivitis and cavernous-sinus thrombosis; Herrell<sup>2</sup> found penicillin effective in the treatment of orbital and facial cellulitis; Florey and Florey<sup>3</sup> obtained a large percentage of cures in 89 cases of blepharitis and acute and chronic conjunctivitis with and without corneal involvement; Griffey<sup>4</sup> reported a successful outcome in a case of gonorrheal conjunctivitis treated with this drug; Struble and Bellows<sup>5</sup> found the local application of penicillin effective in 13 cases of external ocular infections, but ineffective in 2 cases of exudative chorioiditis and 1 case of gonorrheal iridocyclitis. In experimentally produced staphylococcic infections of the cornea (Robson and Scott<sup>6</sup>) and pneumococcic and staphylococcic infections of the anterior chamber (Von Sallman<sup>7,8</sup>) local applica-

tions of penicillin were effective in combating the infections. Because of the apparent growing importance of chemotherapy in the treatment of ocular infections it seemed desirable that further experimental and clinical observations with penicillin be reported.

## METHOD OF TREATMENT OF OCULAR INFECTIONS

Unlike the sulfonamides, penicillin is ineffective when administered orally; therefore, there remain but two routes by which the drug can be administered: either parenterally—that is, intravenously or intramuscularly—or locally—that is, subconjunctivally or topically. Since the efficiency of a chemotherapeutic agent depends not only on its potency but also on its diffusibility and concentration in the infected tissues, it is of fundamental importance in establishing therapeutic principles to know the distribution and penetration of penicillin into the various ocular tissues and fluids after parenteral and local administration of the drug. Penicillin must be given in massive doses parenterally to reach a measurable concentration in the body tissues and fluids. However, since it has been demonstrated that some lots of penicillin are effective, *in vitro*, in dilutions even greater than 1 to 100,000,000 it is likely that bacteriostatic-effective concentrations may be present in the body even when the amount is too small to be assayed by the usual methods.\* The concentration in the ocular tissues and fluids after the administration of a large intravenous dose is listed in decreasing order as follows:

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† Dr. K. K. Chen and his associates of the Lilly Research Laboratories gave valuable aid in this work.

\* By the Florey method, amounts less than 0.1 or 0.2 Oxford units cannot be estimated.



extraocular muscles, sclera, conjunctiva, blood, tears, chorioretinal layer, aqueous and vitreous humors, and cornea. The fact that in some tissues penicillin reaches a higher concentration than in the blood indicates a possible selective absorption mechanism.<sup>5</sup>

When animals were given penicillin in comparable therapeutic dosages the staphylococcal cultures showed no clearing by the Florey method, indicating that the usual recommended dose of this drug is inadequate.

Upon subconjunctival or topical application, penicillin readily diffuses into the tissues and fluids of the anterior segment of the eyeball. The penicillin content in the cornea, conjunctiva, aqueous humor, iris, ciliary body, and scleral tissues is many times greater by this means than after massive intravenous doses. Only a moderate concentration of penicillin is found in the vitreous and the uveal and retinal layers (table 1).

*Parenteral administration.* It has already been stated that only by large intravenous or intramuscular injections can a measurable amount of penicillin be obtained in the posterior half of the globe. Thus, for deep infections of the eye and retrobulbar tissues, the parenteral route, although leaving much to be desired, is the only one available. In such cases, the recommended procedure is the administration of 100,000 units of penicillin (dissolved in 1,000 c.c. normal saline solution) by a continuous intravenous drip for 17 hours. This is followed by intramuscular injections of 1,250 units in 2 c.c. saline every 3 hours, day and night, for 48 hours. However, as a result of the experiments already mentioned (in which animals were given therapeutic dosages), these quantities of penicillin might result in concentrations too small to clear staphylococcal growths in the body tissues and

fluids. Further such inadequate dosages may produce a penicillin-fast organism. Consequently, in serious infections where penicillin is indicated parenterally, it should be administered in much larger doses than those considered adequate up to the present time.

*Local application.* From the data previously mentioned, local penicillin therapy should be effective in combating infections

TABLE 1

CONCENTRATION OF PENICILLIN IN THE GLOBE  
AFTER CONSTANT CORNEAL BATHS  
(20,000 units per c.c.)

Component of Globe	Concentration in Oxford Units per gram or c.c.		
	0.5 hour	1 hour	3 hours
Aqueous humor	3.32	4.18	14.2
Conjunctiva	114.11	177.63	26.34
Cornea	46.23	90.42	27.47
Iris and ciliary body	30.49	35.0	9.18
Vitreous humor	0.92	1.95	trace
Sclera	39.76	57.13	?
Posterior uvea and retina	trace	trace	?

of the anterior segment of the globe and the lids. It should also be of value in stepping up the concentration of the drug in the posterior segment when this method is combined with the parenteral administration. Penicillin has many of the properties required for an effective local therapeutic agent; namely, it is readily diffusible, effective in the presence of purulent secretion and autolytic products, only slightly toxic to leucocytes, and non-irritating to the ocular tissues even in concentrations as high as 20,000 units per cubic centimeter of solution.

As is the case when penicillin is administered parenterally, the solution for local application must be fresh, for even though some lots of penicillin keep their potency if kept cold for a long time, the average sample of penicillin, once placed in solution, begins to lose its potency rapidly. Therefore, it is advisable that no

greater amount of penicillin be put into solution than will be utilized within 24 to 48 hours. The strength of the solution that has been recommended for surface application is 200 to 500 units per cubic centimeter. In this investigation it was thought better to err on the side of too large rather than too small doses for fear that a penicillin-fast organism might develop. Therefore, the solution most frequently employed was one containing 2,500 units of penicillin per cubic centimeter. A drop of the solution was instilled into the conjunctival sac every hour, day and night, except in the less serious cases, in which the drops were used during the waking hours only. Between applications, the penicillin solution was kept in an ice chamber. In cases of severe corneal ulcer the penicillin solution was applied in the form of a constant corneal bath for one hour or more several times a day. For this purpose a Barkan's plastic contact lens or some suitable substitute is satisfactory.<sup>9</sup> Von Sallmann and Meyer<sup>10</sup> recently have advocated the use of iontophoresis in order to increase the concentration of penicillin in the anterior segment of the eyeball.

#### EXPERIMENTAL

Because of the growing importance of local penicillin therapy, this subject is dealt with in detail. The problem of local therapy is essentially that of devising some means of applying the drug so that an adequate concentration is maintained at the site of infection. If a solution be employed, it is necessary to apply the "drops" at very frequent intervals because of its dilution by the tears and subsequent loss through obvious channels. Powdered penicillin would be effective somewhat longer than the solutions, but it has been reported to be irritating to surface wounds and therefore should not be used on the eyeball until further inves-

tigated. Moreover, this method would necessitate the use of large amounts of the drug. This would be unwarranted for such relatively minor infections as those of the lids and conjunctiva. An ointment, if it would not adversely influence the penicillin, would be superior to solutions or powders inasmuch as it would be less affected by tears and require less frequent application. Florey and Florey in their report stated that they employed vaseline as a base and obtained satisfactory results with such an ointment.

An ointment, to be effective, should have the following properties: It must allow close contact of the active agent with the site of infection; be miscible with secretions; not form an inert or impermeable covering, and not be difficult to remove. The following investigation was undertaken to determine which base would be most suitable for local penicillin therapy. The most important property of such a base is its allowing intimate contact and penetration, without harming the tissues. Fortunately, the determination of these factors are relatively simple as is shown by the following experiments.

To 10 grams of each of the following bases 25,000 units of penicillin dissolved in 0.25 c.c. distilled water were added and mixed:

##### (a) Grease base

##### Simple Ointment (U.S.P.)

	%
Unguentum album	
Wool fat	5
White wax	5
White petrolatum	90

##### (b) Oil-in-Water Emulsion-Type Base

	%
Sodium lauryl sulphate	1
Stearyl alcohol	10
Cetyl alcohol	3
Spermaceti	10
Glycerine	15
Water	61

- (c) "Vanishing"-Type Stearate Base
- |                     |    |
|---------------------|----|
|                     | %  |
| Carbitol            | 10 |
| Stearic acid        | 20 |
| Peanut oil          | 4  |
| Potassium hydroxide | 1  |
| Water               | 65 |
- (d) Lubricating Jelly, consisting of tragacanth, quince-seed extract, glycerin, and aromatic oils, and sodium ethyl mercuric thiosalicylate (Lilly) 1:1000 as a preservative.

Twelve rabbits were anesthetized by intravenous injections of sodium amytal. An excess of the preparation to be tested was placed into the conjunctival sac and over the cornea of the eye for one hour. The eyes were staggered in a manner so that every rabbit received a different preparation in each eye, making a total of six determinations for each preparation. At the end of the designated period, the aqueous humor was aspirated from each eye and was tested immediately by the cup method for its penicillin content.

Table 2 shows the penetration of penicillin combined with various types of bases. The penetrability of penicillin in ointments listed in descending order are: "vanishing"-type stearate base, simple ointment, oil-in-water emulsion, and lubricating jelly. The actual concentration

TABLE 2

THE EFFECT OF VARIOUS BASES UPON THE PENETRATION OF PENICILLIN THROUGH THE CORNEA\*

Simple Ointment	Oil-in-Water Emulsion	"Vanishing"-Type Stearate	Lubricating Jelly
A	B	C	D
0.43	0.64	5.19	0.10†
0.47	0.98	3.90	0.10†
0.30	0.10†	3.90	0
0.43	0.10†	2.53	0
0.10†	0.10†	2.80	0
0.79		2.23	0.10†
Avg. 0.42	0.38	3.43	0.05

\* 25,000 units of penicillin per gram base.

† Approximate value.

of the drug in the conjunctival and corneal tissues is much higher than the aqueous level. The penicillin in the "vanishing"-type stearate base in some instances caused a corneal haze. Upon instillation of fluorescein a diffuse staining of the cornea was revealed. This damage to the

TABLE 3

PENETRATION OF PENICILLIN THROUGH CORNEA AFTER CORNEAL BATH AND SUBCONJUNCTIVAL INJECTION

	Corneal Bath	Subconjunctival Injection
Concentration:	20,000 units per c.c.	2,500 units (total)
Time:	1 hour	0.5 hour
1	2.96	0.64
2	3.39	0.43
3	4.33	2.70
4	6.05	0.80
Average	4.18	1.04

epithelium probably was a factor in furthering the penetrability of the penicillin. From these observations, it would seem that the most suitable base for penicillin therapy in ocular infections is the simple ointment (U.S.P.). In this form it remains in the conjunctival sac for a moderate interval of time and leads to a satisfactory concentration in the tissues without causing any damage. An oil-in-water emulsion is the next most satisfactory base. The least penetration of penicillin occurred in the presence of a lubricating jelly.

Although the conditions are unequal, the penetration resulting from a constant corneal bath and from a subconjunctival injection are shown for comparison in table 3. Although the penetration of penicillin in a "vanishing"-type stearate base approximates that obtained when a constant corneal bath with 20,000 units is employed, it is achieved only at the cost of corneal damage. The penicillin content of the tissues of the globe was not determined after application of the

ointment, but it is probably proportionate to the values obtained following corneal baths (table 1).

### THE CLINICAL APPLICATION OF PENICILLIN IN OCULAR INFECTION

From the experimental data already given, it was shown that a high concentration of penicillin can be achieved in the adnexa and tissues of the anterior

the following clinical reports of 46 cases of ocular infections which were treated with penicillin. In most instances, bacteriologic tests were made including blood-agar cultures and smears stained with Giemsa and Gram stains. It was found convenient to divide the cases in this report into six groups as follows:

Group I: Acute and Chronic Staphylococcal Infections of the Conjunctiva and Lids.

TABLE 4  
EFFECT OF PENICILLIN ON ACUTE STAPHYLOCOCCIC CONJUNCTIVITIS

Patient	Cultures and Smears	Penicillin units per c.c.	Results
1. C. M.	Hemolytic Staphylococcal albus	500	Improved in 24 hours; cured in 48 hours
2. J. D.	Nonhemolytic Staphylococcus albus	2,500	Secretion ceased in 24 hours; cured in 48 hours
3. R. K.	Culture negative. Smear showed staphylococci	2,500	Improved in 24 hours; cured in 48 hours
4. M. H.	One colony of nonhemolytic Staphylococcus albus	200 later 500	Right eye cured in 10 days; left eye cured in 3 days
5. C. L.	Nonhemolytic staphylococcus	2,500	Improved in 48 hours; cured in 96 hours
6. N. W.	Hemolytic Staphylococcus albus and Koch-Weeks diplobacillus	500	Cured in 48 hours
7. N. J.	Nonhemolytic Staphylococcus albus	2,500	Cured in 48 hours
8. V. W.	Smears showed staphylococcus	2,500	Improved in 24 hours; cured in 48 hours
9. D. H.	Nonhemolytic staphylococcus and inclusion bodies	2,500	The acute manifestations subsided within 24 hours
10. R. S.	Nonhemolytic Staphylococcus albus	200	Eye cured in 12 hours
11. M. G.	Nonhemolytic Staphylococcus aureus	2,500	Greatly improved in 24 hours; cured in 48 hours
11a. E. D.	Nonhemolytic Staphylococcus aureus	2,500	Marked improvement in 48 hours

segment, whereas the concentration within the posterior segment of the globe is, at the very best, minimal. As a corollary to this, it might be expected that external ocular tissues, because of their accessibility, are readily cured by the use of this drug, whereas deep infections respond poorly or not at all. The correctness of this supposition is borne out by

Group II: Streptococcal Infections of the Conjunctiva.

Group III: Corneal Ulcers and Epithelitis.

Group IV: Unidentified Infections of the Conjunctiva. In this group bacteriologic tests were either negative or not carried out.

Group V: Miscellaneous Infections of

Conjunctiva and Lids. This group consisted of four cases of conjunctivitis. There was one case each of the following infections—gonococcus, Koch-Weeks diplobacillus, inclusion bodies, and an unidentified gram-positive organism. One case of hordeolum was also included.

Group VI: Infections of the Uvea.

This group included one instance of gonococcal uveitis and two of exudative choroiditis of undetermined cause.

GROUP I: ACUTE AND CHRONIC STAPHYLOCOCCIC INFECTIONS OF THE CONJUNCTIVA AND LIDS (table 4)

(a) *Acute staphylococcic conjunctivitis.*

There were 12 cases (8 bilateral and 4

whether the causative agent was a Staphylococcus, for after three attempts at culture growth one colony of nonhemolytic Staphylococcus albus only was found. The inflammatory signs, which improved slowly with 200 units of penicillin per cubic centimeter of solution, became rapidly better when the concentration was increased to 500 units per cubic centimeter. The clinical cure required 10 days. At this time, the second eye became involved and, in contrast to the first, cure was complete in three days.

In case 9 (D. H.) in which there was a negative history regarding exposure in a swimming pool, the patient had inclusion bodies in addition to staphylococci. The acute manifestations undoubtedly caused by the staphylococci subsided

TABLE 5  
COMPARISON OF PENICILLIN WITH OTHER FORMS OF THERAPY

Patient	Culture and Smears	Cure with Penicillin Therapy	Cure in Control
J. D.	Nonhemolytic Staphylococcus albus	2 days	Over five days with zinc sulphate 0.2 percent
M. G.	Nonhemolytic Staphylococcus aureus	1 day	Over three days with 10 percent argyrol
N. W.	Hemolytic Staphylococcus albus and Koch-Weeks diplobacillus	2 days	Three days with zinc sulphate 0.2 percent
W. T.	Streptococci	2 days	Two days with metaphen 1-2,500 aqueous solution

unilateral) of acute conjunctivitis caused by a Staphylococcus. The organisms identified by blood-agar culture were hemolytic and nonhemolytic Staphylococcus albus and nonhemolytic Staphylococcus aureus. Of the 12 cases, penicillin was administered to 4 bilaterally and to 8 unilaterally. Two bilateral cases and 7 unilateral cases responded rapidly to the drug so that clinical cure occurred within 12 to 48 hours.

In case 4 (M. H., the slowest to respond to treatment) it was questionable

within 24 hours, whereas the chronic inflammation showed no improvement until the third week, at which time there was a noticeable change for the better. No definite conclusion can be drawn, because unavoidable circumstances prevented further observation. If this case, which presented neither pannus nor scarring of the conjunctiva, was one of true trachoma it is the only such recorded case treated with penicillin. In three of the bilateral cases, two of the less severely inflamed eyes received 0.2-percent zinc-sulphate solution

and one received 10-percent argyrol. In all three instances, a clinical cure occurred in a shorter period in the eye receiving penicillin (table 5).

(b) *Chronic staphylococcic conjunctivitis*. In chronic conjunctivitis, the results obtained by treatment with penicillin are quite spectacular. In this group there were seven cases in which the infectious agent was either hemolytic or nonhemolytic

13 (L. A.), was interesting in that the ocular infection present for six months was probably secondary to sycosis vulgaris, a staphylococcic infection of the face. In spite of vigorous treatment, the conjunctiva remained inflamed and discharge and tearing profuse. Within 48 hours after penicillin therapy was instituted, a marked improvement was noted, and the conjunctiva and lids were completely cured in six days. Treatment was

TABLE 6  
EFFECT OF PENICILLIN IN CHRONIC STAPHYLOCOCCIC CONJUNCTIVITIS

Patient	Duration	Cultures and Smears	Remarks
12. A. M.	2 months	Nonhemolytic staphylococci	Improved in 24 hours; cured in one week
13. L. A.	6 months	Staphylococci (sycosis vulgaris)	Improved in 48 hours; cured in six days. Reinfection from the face occurred when drug was stopped; lids improved when medication was resumed
14. E. K.	5 months	Hemolytic <i>Staphylococcus albus</i>	Cured in two days
15. J. G.	? years	Nonhemolytic <i>Staphylococcus albus</i>	Slight improvement in two days, but no improvement in the gritty, dry, and hot sensation. Schirmer test revealed lack of tears
16. J. E.	3 months	Staphylococci	Moderate improvement in four days. Developed signs of drug hypersensitization
17. H. G.	15 years	Staphylococci and diphtheroids	Improved in three days; cured in three weeks
18. G. T.	2 years	Nonhemolytic staphylococcus	Infected eye socket. Redness and purulent discharge decreased in two days and discharge absent after five days

staphylococci (table 6). The infections had persisted from 2 months to 15 years in spite of the usual forms of therapy. All but one case were cured in a few days to three weeks. For example, in case 17, H. G., whose conjunctivitis had persisted for 15 years, was cured in three weeks with penicillin therapy. In case 15 (J. G.), the infectious agent (nonhemolytic *Staphylococcus albus*), disappeared within two days, but the hot, dry, gritty sensation persisted. The corneas, after staining with fluorescein, revealed fine punctate staining areas, and the Schirmer test disclosed a deficiency of tears. Case

stopped at this time and within a few days reinfection took place from the skin of the face. This time the penicillin therapy was directed not only to the eyes but also to the skin in the form of an ointment composed of an emulsion base. Marked improvement in eyes and face occurred within two days and the eyes were considered normal in a week.

(c) *Chronic blepharoconjunctivitis and dacryocystitis*. Five cases of chronic blepharoconjunctivitis were treated with penicillin (table 7). In case 19 (M. V.), cultures showed nonhemolytic staphylo-

cocci. Remarkable improvement occurred in two days and the condition was cured in two weeks. The drug was continued for 3 days beyond this period, making a total of 17 days' treatment. Observation was continued for one month but there was no recurrence. Case 20 (J. F.), diagnosed as acne rosacea and blepharoconjunctivitis, in which culture revealed nonhemolytic *Staphylococcus albus*, did not re-

spond to penicillin therapy, the lid margins were greatly improved, but the conjunctivas remained inflamed. In case 24, D. D., also suffering from seborrheic dermatitis, had negative ocular smears and cultures. The lid margins had a great many scales and crusts. After the use of penicillin for seven days, the inflammation and crusts disappeared from the lid margins and the conjunctiva became nor-

TABLE 7

PENICILLIN THERAPY IN CHRONIC BLEPHAROCONJUNCTIVITIS AND IN DACRYOCYSTITIS

Patient	Diagnosis	Cultures and Smears	Remarks
19. M. V.	Blepharoconjunctivitis	Nonhemolytic staphylococci	Conjunctiva normal in 48 hours; lids normal in 2 weeks; drug stopped after 17 days
20. J. F.	Blepharoconjunctivitis and Acne rosacea	Nonhemolytic <i>Staphylococcus albus</i>	No improvement in 10 days, then multivitamin preparation was prescribed and penicillin continued. Marked improvement by third week.
21. R. M.	Blepharoconjunctivitis	Smears and cultures negative	Improvement noted in five days; cured in eight days
22. S. L.	Closure of nasolacrimal duct in newborn	Staphylococci	Secretion continued but became sterile
23. D. C.	Blepharoconjunctivitis associated with seborrheic dermatitis	Occasional staphylococcus	Moderate improvement shown in lid margins, but conjunctiva remained red, even after three weeks of penicillin therapy
24. D. D.	Blepharoconjunctivitis associated with seborrheic dermatitis	Negative	Lids and conjunctiva cured in seven days

spond to penicillin therapy within 10 days. At that time, a multivitamin preparation was prescribed and the penicillin continued, resulting in a moderate improvement in about two weeks, when observations were unavoidably discontinued. Case 21 (R. M.), in which cultures and smears were negative, was cured in eight days. The treatment was continued for an additional week. Case 23 (D. C.), in which cultures were negative but smears showed an occasional staphylococcus, there was seborrheic dermatitis of the face and scalp. The eyelids were covered with scales and crusts and the conjunctivas of both eyes were inflamed. Following three

weeks of penicillin therapy, the lid margins were greatly improved, but the conjunctivas remained inflamed. In case 24, D. D., also suffering from seborrheic dermatitis, had negative ocular smears and cultures. The lid margins had a great many scales and crusts. After the use of penicillin for seven days, the inflammation and crusts disappeared from the lid margins and the conjunctiva became nor-

#### GROUP II: STREPTOCOCCIC INFECTIONS OF THE CONJUNCTIVA

There were three cases in this group. In one streptococci occurred in short chains and in another *Streptococcus*



viridans in a pure culture (table 8). Both of these cases were cured with penicillin in 48 hours. In the case of the third patient (case 27), the conjunctivitis was

Three cases of episcleritis were treated with penicillin drops (table 9). In one case, the eye became white in 24 hours, whereas in the other two cases, the eyes

TABLE 8  
PENICILLIN THERAPY IN ACUTE STREPTOCOCCIC CONJUNCTIVITIS

Patient	Culture	Remarks
25. W. T.	Streptococci (short chains)	Secretion absent in 24 hours; culture and smears negative in 48 hours
26. J. C.	Pure culture of <i>Streptococcus viridans</i>	Right eye cured in 48 hours; left eye cured in 36 hours
27. H. S.*	Hemolytic streptococci	Corneal ulcer and conjunctivitis cured in six days

\* See table 9.

associated with a severe corneal ulcer and is discussed in that section (group III).

#### GROUP III: CORNEAL ULCERS AND EPISCLERITIS

There were three cases of corneal ulcers (table 9). Two cases (10, R. S., and 11, M. G.), already mentioned in the section on acute staphylococcal conjunctivitis, are also included in this group. The marginal ulcers and conjunctivitis in these cases were cured in 12 hours and 48 hours, respectively. A third case (27, H. S.), also mentioned in the series of streptococcal conjunctivitis cases, presented a progressive corneal ulcer with marked generalized injection and blepharospasm. Cultures taken from the ulcer and conjunctiva revealed a hemolytic streptococcus. The patient was treated with penicillin drops hourly (2,500 units per cubic centimeter), day and night, combined with a solution of similar concentration. Progress of the corneal ulcer stopped in 24 hours, and the congestion and blepharospasm lessened noticeably. The corneal lesion, although gradually decreasing in size, stained with fluorescein for six days, leaving a macular corneal scar. Two weeks later, the scar was considerably smaller and nebular in character.

improved more slowly and were not considered cured until after one week had elapsed (table 9).

#### GROUP IV: UNIDENTIFIED INFECTIONS OF THE CONJUNCTIVA

There were 9 cases of conjunctivitis (6 acute and 3 chronic in type) in which smears and cultures were either negative or were not taken (table 10). In case 31, C. P. had a severe unilateral acute conjunctivitis in which marked generalized injection, edema of the lids, and slight secretion were present. Cultures and smears were negative. The eye was completely normal in three days following penicillin therapy. The other five acute cases of conjunctivitis in this group were cured in 12 to 72 hours. The three cases of chronic conjunctivitis belonging to this group were cured in 2, 3, and 8 days.

#### GROUP V: MISCELLANEOUS INFECTIONS OF THE CONJUNCTIVA (TABLE 11)

*Gonorrheal ophthalmia.* C. P. (case 40) was seen on the fifth day of the acute conjunctival infection of the left eye. All this time there were severe swelling of the lids, chemosis, and profuse purulent discharge in which gram-negative diplococci were found, intra- and extracellularly. Boric-acid irrigations and instillations of

TABLE 9

EFFECT OF PENICILLIN IN CORNEAL ULCERS AND IN EPISCLERITIS

Patient	Organism	Remarks
10. R. S.	Nonhemolytic Staphylococcus albus	Marginal ulcer cured in 12 hours
11. M. G.	Nonhemolytic Staphylococcus aureus	Marginal ulcer cured in 24 hours
27. H. S.	Nonhemolytic streptococcus	Deep corneal ulcer treated with corneal baths. Progress of ulcer stopped in 24 hours. Staining area gradually decreased, no staining after six days
28. A. O.	Episcleritis	Eye white in one week
29. M. T.	Episcleritis	Eye white in 24 hours
29a. W. L.	Episcleritis	Eye white in one week

penicillin every 30 minutes led to a marked improvement within 24 hours, indicated by the absence of organisms in smears and objective findings. The conjunctiva was entirely normal on the tenth day.

*Koch-Weeks conjunctivitis.* One case of acute Koch-Weeks conjunctivitis with secondary staphylococcal infection was treated with penicillin. The eye was cured in 48 hours.

*Trachoma (?)*. In case 9, D. H., already mentioned in the section on acute staphylococcus conjunctivitis, a young Negro soldier, had a history of having had "red eyes" for over five months. The redness

became markedly worse a week before penicillin was administered. Smears stained with Giemsa revealed inclusion bodies, and cultures showed colonies of nonhemolytic Staphylococcus albus. Panus formation and scarring of the palpebral conjunctiva were absent. The acute manifestations subsided within 24 hours after instituting treatment. Smears and cultures taken in 48 hours were negative. After two weeks, the chronic inflammation gradually subsided. This is the first reported case of probable trachoma treated with penicillin.

*Acute conjunctivitis caused by an un-*

TABLE 10

EFFECT OF PENICILLIN IN CONJUNCTIVITIS OF UNKNOWN CAUSE

Patient	Type	Culture and Smears	Remarks
30. F. R.	Acute	Not taken	Cured in 24 hours
31. C. P.	Acute with edema of lids	Negative	Cured in three days
32. C. R.	Chronic	Not taken	Cured in eight days
33. L. K.	Chronic	Negative	Cured in three days
34. J. P.	Acute	Negative	Cured in three days
35. D. B.	Acute	Negative	Cured in 24 hours
36. H. B.	Acute	Not taken	Cured in 12 hours
37. C. M.	Acute	Negative	Cured in three days
38. J. F.	Chronic	Negative	Improved in 24 hours; cured in 48 hours

identified small gram-positive organism. Case 39 (H. H.) was that of an acute conjunctivitis from which small gram-positive organisms were recovered. Recovery was complete in 24 hours with penicillin therapy.

*Hordeolum.* One case of hordeolum, seen in its third day, was treated with penicillin drops and ointment. Marked improvement was noted in 24 hours. On the third day of treatment, the patient

be differentiated from another group of reactions consisting of redness and swelling of the conjunctiva and skin surrounding the eyes observed after the use of certain samples of penicillin. Four of the cases receiving penicillin therapy for ocular infections developed true hypersensitization reactions. As far as the writer is able to determine, this is the first report of such reactions developing during the course of penicillin therapy. Case

TABLE 11  
PENICILLIN THERAPY IN MISCELLANEOUS INFECTIONS OF CONJUNCTIVA AND LIDS

Patient	Diagnosis	Remarks
6. N. W.	Koch-Weeks conjunctivitis with secondary staphylococcal infection	Cured in 48 hours
9. D. H.	Trachoma (inclusion bodies and non-hemolytic <i>Staphylococcus albus</i> )	Acute manifestation subsided in 24 hours; chronic manifestations became noticeably improved after three weeks' therapy
39. H. H.	Conjunctivitis due to an unidentified small gram-positive organism	Eyes normal in 24 hours
40. C. P.	Acute gonorrheal conjunctivitis	Marked improvement in 24 hours. Conjunctiva normal in 10 days
41. B. F.	Hordeolum, third day (hemolytic <i>Staphylococcus albus</i> )	Marked improvement in 24 hours, obtained with penicillin drops and ointment

developed a hypersensitization reaction on the skin of the lids.

#### GROUP VI: UVEAL INFLAMMATION

There were three cases in this group, two of chronic exudative choroiditis and one of gonococcal iridocyclitis. Massive doses of penicillin administered parenterally and locally seemed to have little or no influence on the progress of the disease.

#### LOCAL TOXIC MANIFESTATION OF PENICILLIN

Up to the present time, there have been no reports indicating that the local application of penicillin produces a drug hypersensitization. This phenomenon must

11 (M. G.), treated for acute staphylococcal conjunctivitis with a marginal ulcer, was cured in one day. Two weeks later, the patient returned with bilateral conjunctivitis with follicles which did not respond to penicillin, even though the smears, which at first showed staphylococci, became negative. On the fifteenth day of penicillin treatment, hypersensitization phenomena appeared on the lids, as manifested by redness and edema. Later the skin became wrinkled, itchy, and scaly. When the penicillin was stopped, the skin returned to a normal state in a few days. At this time, fresh penicillin was instilled for one day, causing the reappearance of the hypersensitization phenomena. The drug was entirely discontinued in this

case. In case 16, J. E., treated for chronic staphylococcic conjunctivitis, developed redness, swelling, and itchiness of the lids on the sixth day. A patch test showed hypersensitization to penicillin. Case 30 (F. R.) was treated with penicillin for acute conjunctivitis in which smears and cultures were negative. The eye became white within 24 hours. Several weeks later, the patient developed an acute bilateral conjunctivitis. Penicillin drops were prescribed. The next day, the patient developed a marked redness, edema, and itchiness of the skin of the lids followed by wrinkling and scaliness. In case 40, J. F., suffering from an hordeolum, was treated with penicillin drops and ointment. The swelling and redness of the hordeolum subsided within 24 hours. The medication was continued for two more days and on the third day, redness, edema, and itchiness developed, which was followed by wrinkling and scaliness. The patch test with powdered penicillin was positive.

#### COMMENT

It could be predicted from the laboratory experiments that the best results from penicillin therapy would be obtained in external ocular infections, rather than those involving the posterior segment. The clinical observations of Florey and Florey and those reported herein confirm this prediction.

In the evaluation of penicillin therapy, the rapidity of improvement must be considered in both acute and chronic ocular infections. If in acute infections the time required to obtain a cure with penicillin is repeatedly less than with the usual therapeutic methods, it may be assumed that the drug was effective. In chronic infections, particularly those in which other methods have been unsuccessful, if rapid improvement follows the institution of penicillin therapy, it is likely that the drug was instrumental in bringing this about.

Yet, another means of appraising penicillin therapy is available in cases of bilateral ocular infections. In such instances, one eye, preferably the worse one, is treated with the drug while the second eye is the control. Although the number of cases in this series is small, penicillin, evaluated by these criteria, has proved to be of value in external ocular infections caused by penicillin-sensitive organisms. Thus, in 10 out of 12 cases of acute staphylococcic conjunctivitis cure was achieved within 48 hours. In case 5 (C. L.), in which the drops were used infrequently, it took 96 hours for a cure. In case 4 (M. H.), wherein the response to penicillin was slow, it was questionable, as already stated, whether the staphylococcus was the causative agent. It has also been demonstrated that rapid cure occurred in the cases of acute conjunctivitis due to some other organisms.

Even more remarkable and therefore confirming the efficacy of penicillin in external ocular infections, was the rapid improvement or cure in the cases of chronic conjunctivitis. In most of these, the infections had been treated by other means during periods of months or even years. Cure within a few days or weeks, in such instances, is certainly a strong indication that penicillin was an important agent in the rapid healing. Where penicillin did not cure, the failure could be attributed to such associated factors as keratoconjunctivitis sicca, acne rosacea, or drug hypersensitization.

It is quite possible that penicillin might prove to be equal to silver nitrate without the disadvantages of the latter in the prophylactic treatment of gonorrheal ophthalmia of the newborn. Further it may be used as a preventive measure for intraocular infections following surgery. This would be particularly helpful where bacteriologic tests are impractical prior to intraocular surgery.

## SUMMARY AND CONCLUSIONS

1. Penicillin reaches the ocular tissues within a few minutes after intravenous injection.

2. After a large dose of penicillin is administered intravenously, it appears in the ocular tissues listed in decreasing order of concentration as follows: extraocular muscles, sclera, conjunctiva, blood, tears, chorioretinal layer, aqueous and vitreous humors, and cornea. It has never been detected in the crystalline lens. In this respect, the lens is similar to the cerebrospinal fluid, brain, and nerve tissues.

3. Local application of penicillin leads to a very high concentration of the drug in the tissues of the anterior segment of the globe.

4. The following four ointments, in which the penetrability of penicillin was tested, are listed in the order in which

they are clinically recommended: simple ointment, oil-in-water emulsion, and lubricating jelly. The "vanishing" stearate type of a base, in which penicillin seems to have the greatest power of corneal penetration, is not recommended because of its possible damage to the corneal epithelium. However, it may be used on the skin of the lids.

5. Penicillin was found to be effective in the clinical treatment of acute and chronic infections of the lids, conjunctiva, and cornea produced by penicillin-sensitive organisms.

6. It was found ineffective in two cases of exudative choroiditis of undetermined origin and in one case of gonorrheal iridocyclitis.

7. Susceptible individuals may become hypersensitive to penicillin.

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## DISCUSSION

DR. H. S. GRADLE: Has Dr. Bellows any information as to the penicillin concentration in the secondary aqueous.

DR. BELLOWES: Very little work has been done on that. When massive doses

are given intravenously the amount of penicillin goes up very slowly for a whole hour. If the first aqueous is removed during this time, the second aqueous shows a higher concentration of penicillin.

However, a similar rise occurs in aqueous humor for the first hour without paracentesis; that is, if samples of primary aqueous humors are examined at 15, 30, 45, and 60 minutes, each sample will be successively higher in concentration. The second aqueous, removed at the end of a 30-minute period, for example, does not contain much more penicillin than does the first aqueous from the other eye aspirated at the same time.

DR. CLYDE A. CLAPP: Were these cases of pure cultures of staphylococci and streptococci?

DR. BELLOWES: Most of the staphylococci and all of the streptococci cases reported were pure cultures.

DR. H. S. GRADLE: In what form was the penicillin used in the treatment of local conjunctival infection?

DR. BELLOWES: At first patients were treated with drops, using 2,500 units per cubic-centimeter concentration. Later, a simple U.S.P. ointment was used (penicillin concentration, 2,500 units per gram of ointment).

DR. ALBERT C. SNELL: Must these solutions be made fresh or can they be preserved?

DR. BELLOWES: The solution preferably should be fresh because the potency decreases gradually. However, some samples of penicillin keep their potency even in solution for great periods of time.

# CORNEAL HEALING: ADHESIVE POWER OF AQUEOUS FIBRIN IN THE RABBIT\*

## PRELIMINARY REPORT

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While studying the placement of sutures in incisions in the rabbit cornea, we were attracted by the firm apposition of the wound edges before actual healing began. The sutures were not in any degree responsible for this firm approximation as attested by their removal and then their omission. An incision in the cornea proper engages no blood vessels. There is no adjacent structure nor substance adjacent to such an incision except the aqueous. It therefore remained to ascertain the quantitative and qualitative adhesive power of the aqueous for corneal wounds. The obvious difference between such strong adhesion in the rabbit and the comparatively weak response in the human suggests many interesting possibilities for the promotion of wound healing.

Recently attempts have been made to find a biologic substitute for sutures that is mechanically strong, nonirritating, and capable of complete absorption. Young and Medawar<sup>1</sup> in 1940 introduced the use of a fibrin coagulum as a substitute for nerve sutures. This work was extended by Tarlov and Benjamin.<sup>2</sup> Sano<sup>3</sup> developed an adhesive fraction from red blood cells that he used as a successful substitute in skin grafting. Recently Cronkite and Lozner<sup>4</sup> used the method of Young and Medawar in skin grafting with promising results. There are, however, no reports in the literature of any attempt to apply this procedure to replace or enhance the use of sutures in wounds of the globe.

\* Read at the fourteenth scientific meeting of the Association for Research in Ophthalmology, at Chicago, June 13, 1944.

## THE NATURE OF CORNEAL-WOUND HEALING

Weinstein<sup>5</sup> was one of the earliest to report histologic events of wound healing. He reported mitoses in the basal cells of the corneal epithelium near the wound margins one hour after injury and over the entire cornea in four hours. Ranvier<sup>6</sup> did not observe mitoses in the corneal epithelium until 12 hours, and considered the process of epithelial sliding over Bowman's membrane of primary importance. Weinstein's work concerning union of the substantia propria is generally accepted. He found that mitoses of the keratoblasts appeared adjacent to the wound on the second day but are not active until the fifth and sixth days. In short, the only histologic evidence of corneal healing within the first 4 hours after injury occurs in the epithelium, a structure which can offer little mechanical support in maintaining approximation of the wound edges. In the human, this process has been aided by the mechanical approximation of the wound edges by sutures.

Many observers have considered the role of fibrin in the initial phase of corneal wound healing.<sup>7-12</sup> Parsons<sup>7</sup> states, "the secondary aqueous is capable of forming a fibrinous coagulum which is important in the healing process." Gradle,<sup>9</sup> in his second type of corneal transplant, eliminated sutures entirely and found this method superior except that in 15 percent of the cases the transplant failed to adhere and was removed by the action of the lids. He was unable to account for this complication and discarded the method for this reason. Many who were working



with transplants at that time observed the same tendency.<sup>13</sup> Ascher<sup>14</sup> and Elschnig<sup>15</sup> tried to relate this failure to adhere to a serologic factor but were unsuccessful. Magitot<sup>16</sup> also failed to determine the cause. The action of fibrin was not considered by these authors. Busacca<sup>17</sup> used "coagulen," a thromboplastic anticoagulant, to facilitate wound healing. This substance was subcutaneously injected preoperatively and used locally as a hemostatic. He observed the formation of a dense coagulum which was removed before resumption of the operation. Having had one complicated case, this worker discarded the method. Weinstein<sup>5</sup> considered the role of fibrin unimportant.

The adhesive power of the aqueous has obviously been given very little consideration in the healing of corneal wounds in man. The approximation of such wound edges appear to depend initially on gravity. If the anterior chamber pressure is low and there is recession of the intraocular structures, the edges have a better chance to approximate than if there is a forward movement of the intraocular structures with consequent pressure against the posterior cornea.

#### EXPERIMENTS ON RABBITS

*Adhesive power of the normal secondary aqueous.* The rabbit was considered ideally suited to this work, for the secondary aqueous forms a heavy coagulum. We assumed that this coagulum was instrumental in uniting corneal-wound edges and proceeded to test the validity of this idea.

After a number of trials, it was found that corneal transplants prepared after the method of Gradle's second type and Thomas's third type<sup>13</sup> were most suitable. Albino rabbits about six months old were anesthetized with basal intravenous nembutal, fortified locally with cocaine, and maintained with ether. The pupil under

anesthesia was found to dilate to about 5 mm. A transplant, 4 mm. to 5 mm. in diameter, could be uniformly prepared if the operator followed the inner edge of the pupillary margin. A traction suture was inserted in the center of the corneal apex, penetrating to about one half the corneal thickness before the transplant was incised. The transplant was made with a small cataract knife by puncture and counterpuncture, the knife drawn upward and emerging about 4 mm. below the upper limbus. The hinge left below was severed with scissors. This detached section was left *in situ* and the edges carefully adjusted with a repositor. The lids, having been paralyzed by canthotomy, were allowed to remain open, and saline was dropped on the cornea at intervals. The tension necessary to rupture the wound after the proper time interval was determined in the following manner: The animal was killed and the traction suture attached to the corneal transplant was tied to one beam of an analytical balance. Water was slowly dropped into a beaker previously balanced on the opposite beam until the transplant was suddenly separated from its bed. The weight of water was the measure of the wound tension.

Normally fibrin strands form so rapidly in the rabbit aqueous that it was necessary to complete the operation within two minutes; otherwise the experiment was discarded. At the end of four hours the wound was so firmly united that the rabbit's head required support against the increasing tension on the transplant. The entire globe was seen to move forward out of the orbit as a result of the traction. Hyphemia occasionally developed just prior to the wound rupture due to the great tension on the globe. The entire anterior chamber was filled with fibrin and the fibrin strands filled the conjunctival sac and adhered to the lid margins. These latter strands were carefully

severed with scissors prior to all measurement determinations to eliminate all mechanical support except that due to the fibrin in the anterior chamber and on the wound edges. It is interesting to note that the transplant weighed approximately

TABLE 1

## MEASUREMENT OF CORNEAL-WOUND TENSION

Time hours	Corneal-Wound Tension grams (average)		
	Normal	Heparin +Fibrin	Heparin
$\frac{1}{2}$	8.39	6.66	0.84
1	14.43	9.24	1.80
2	18.71	13.22	3.03
3	25.11	17.09	3.48
4	31.60	20.70	4.42

.003 gm. and that at the end of four hours the fibrin sealing of the wound was so strong it could support 11,000 times its own weight. The average of all readings is given in table 1 and figure 1.

*The effect of heparin on the aqueous fibrin.* Fibrin is produced by the combination of thrombin and fibrinogen. This simplified statement is sufficient for the present discussion. Since heparin is known to interfere with the formation of fibrin, it was used for this purpose. The same determinations could then be made with minimal fibrin formation. The primary aqueous was aspirated and replaced by an equal volume of heparin (product of Lederle, containing 10 mg. of purified sodium salt of heparin in each cubic centimeter). The tensions producing wound rupture were again determined for a period of time up to four hours. In this series there was an approximate reduction of 87 percent in the tension necessary to cause wound rupture regardless of the time interval.

*Addition of thrombin-fibrinogen after heparin.* In order to complete the cycle of

the adhesive action of normal fibrin and its reduction after the addition of heparin, its return was consummated by the injection of thrombin and fibrinogen into a heparinized aqueous. This restored the adhesive power of the aqueous as shown in table 1.

*Fibrin formation in the rabbit aqueous.*

The formation of fibrin is not completely understood at present. Reduced to the simplest terms sufficient for this discussion, fibrin is the product of the reaction of thrombin and fibrinogen. Fibrinogen is a soluble protein found in blood plasma and various body fluids. This substance is converted into insoluble fibrin by the

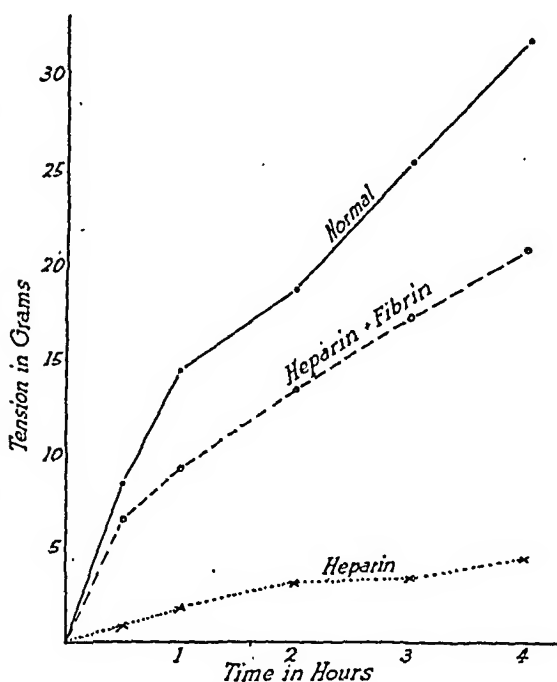


Fig. 1 (Brown and Nantz). Role of fibrin in the initial phase of corneal-wound healing in rabbits.

enzymelike action of thrombin. The clotting of blood and various body fluids depends on this process. In the absence of fibrinogen, clotting cannot occur. Normally thrombin is present in the body in an inactive form called prothrombin which requires calcium and thromboplas-

tin for activation. Thromboplastin is an intracellular enzymelike substance or group of substances that is locked in all body cells and is liberated by mechanical or other trauma. When liberated from the cell, thromboplastin in the presence of calcium converts prothrombin into thrombin, which, in turn, converts fibrinogen to the insoluble fibrin. Thus, when the cornea is incised the wound edges liberate thromboplastin from the cellular elements. This substance converts aqueous prothrombin into thrombin, which, in turn, converts aqueous fibrinogen into insoluble fibrin. As the aqueous filters through the wound edges, this process continues until a dense fibrin coagulum completely seals the wound in the rabbit. There is a good deal in the literature concerning the total protein content of the primary aqueous.<sup>18-23</sup> However, there are a few quantitative studies of the fibrinogen content of the primary aqueous in rabbit and man. Hayano<sup>24</sup> demonstrated fibrinogen in the aqueous of rabbits but not in cattle. He found thrombin in both. Irvin,<sup>25</sup> using the Denis-Ayer method, found no fibrinogen in rabbit aqueous. The method Irvin used was based on a gross clotting of the withdrawn aqueous, which was a relatively inaccurate method. Hagen<sup>26</sup> found that the secondary aqueous in man did not contain an increase in fibrinogen, whereas the secondary aqueous in the rabbit contained a marked increase. On this basis, he assumed that in man the secondary aqueous is derived from the vitreous but presumably not in the rabbit. Those who sought to determine the fibrinogen content of human primary aqueous report that they either found none or traces.<sup>22, 23</sup>

The relatively high fibrinogen content of the normal primary aqueous in rabbit can be demonstrated qualitatively by injecting a small amount of full-strength thrombin into the anterior chamber. A

fibrin clot will form in the anterior chamber within a few minutes. This clot is slowly absorbed in five to six days without inducing gross ocular irritation. Quantitative determinations of fibrinogen in primary rabbit aqueous were done by the method of Quick.<sup>27</sup> A composite of the determinations was found to be about

TABLE 2

Fibrinogen content in Mg./100 c.c.		
	Blood Plasma	Aqueous
Human	200-400	0-trace
Rabbit	200-300	39-43

20 percent of the blood plasma level or about 40 mg. per 100 c.c. (table 2). Fibrinogen content of the human aqueous produced a bare trace, which we were unable to measure.

#### DISCUSSION

The profound difference between the clotting of the aqueous in the rabbit and man after a corneal incision has been noted before. To overcome this in experimental work on rabbits Friedenwald<sup>28</sup> used heparin and Bellows and Hchuen<sup>29</sup> used chlorazol-fast pink. In man no such early tendency is noted unless the anterior chamber is left intact and the aqueous is aspirated four or five times. After it has been allowed to refill, the fourth or fifth aqueous begins to clot. The tendency of the wound edges to adhere after a corneal section for cataract extraction is seen occasionally in individuals, especially if there is bleeding, but there is no general uniform tendency of such wound edges to be strongly united. This is attested by the constant search for the ideal suture for cataract extractions.

The marked difference in the fibrinogen content in the aqueous of man and rabbit undoubtedly accounts for the strong mechanical adhesion of the corneal

wound edges in the rabbit as contrasted with that in man. The application of this principle in corneal surgery in man is being studied and will be reported later.

#### SUMMARY

1. The wound edges after an incision in the rabbit cornea are approximated strongly by the secondary aqueous.

2. A wound surrounding a transplant will support 11,000 times the weight of the transplant in four hours.

3. This sealing is accomplished by the fibrin produced in the aqueous.

4. The aqueous fibrin is a product of

the union of thrombin from the wound edges and fibrinogen in the aqueous.

5. Heparin was injected into the anterior chamber to replace aspirated aqueous. This agent markedly decreased the adhesive power of the secondary aqueous after corneal incision.

6. The heparin was then replaced by thrombin-fibrinogen and the adhesive power was restored.

7. No comparable action occurs in man. There is no more than a trace of fibrinogen in human aqueous and a correspondingly diminished adhesive power.

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## NATIONAL OPHTHALMOLOGICAL SOCIETIES IN THE UNITED STATES

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The four national ophthalmic societies in the United States, brief histories of which are herewith presented, have all originated in answer to particular demands and are fundamentally different. Whether all have a sufficient reason for an independent existence is another question and will not be discussed here. It may be pointed out that attendance at only three different times and places will cover all four meetings because the program for the Association for Research is always one day before the scientific session of the Section on Ophthalmology of the American Medical Association and held in the same city as that in which this organization meets.

On January 8, 1864, a small group of men met in New York, in the office of Dr. Henry D. Noyes, to lay plans for the formation of an ophthalmic society. It was decided to assemble the ophthalmologists of the country at the gathering of the American Medical Association in New York in that same year. This convention took place on June 7, 1864, at the New York Eye and Ear Infirmary in New York City. The association was organized under the name of the American Ophthalmological Society, and a constitution was adopted. It was stated that "the purpose of this society shall be for the advancement of the ophthalmic science and art." This society met annually thereafter and many new members were added to the original 19.

The American Ophthalmological Society was the first of the American ophthalmic associations to be organized. It originated

in the manner of a club and has always retained something of that atmosphere. Membership is by invitation and is limited to 225. Because it was started by distinguished and far-seeing physicians and has been carried on by many of the most enlightened ophthalmologists of this country and of Canada, it has retained its preëminence among special societies. Obviously, however, not all of the outstanding eye doctors of the United States can be included in such a small membership. It, therefore, is not fully representative of ophthalmology in America. Because of its brilliant enrollment many classical original contributions have been presented before it. A delightful social aspect has always surrounded its meetings, which are oftenest held at Hot Springs in the beautiful mountains of Virginia. Every joint committee of ophthalmology includes representation from this society as such, and among its members have been many of the leaders of ophthalmic thought in America.

The Section on Ophthalmology of the American Medical Association was formed in 1877, 30 years after the organization of the parent body. This, the sixth section of the American Medical Association, originated as a section for ophthalmology, otology, and laryngology, and continued thus until 1888, when the Section on Ophthalmology became a separate body.

The first chairman of the combined section was Herman Knapp of New York. The first meeting was held in Atlanta, Georgia, on May 6, 1879. The officers consist of a chairman, a vice-chairman, and a secretary. The Section appoints a representative to the House of

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Delegates of the American Medical Association for a two-year period, who officially represents the Section. Meetings are held annually for three half-day sessions at which scientific papers are read and discussed.

The ophthalmic section of the American Medical Association is the official representative of organized medicine in the United States. It is here that matters concerning administration and legislation pertinent to the specialty are discussed. Relationships with other organizations concerned with vision are here defined. Actions taken by this body are presented to the administrative section of the American Medical Association by the delegate from the Section, and are there accepted or rejected.

One of the great advantages of the meetings of the American Medical Association is the opportunity there available to meet with doctors in other specialties and to hear the best papers in branches other than one's own. Here, too, are the greatest number and variety of exhibits. Walking through the miles of aisles between the displays of thousands of manufacturers whose products are of interest to physicians, is in itself a liberal education.

The Association for Research in Ophthalmology, companion to the Section, was organized about 20 years ago for the purpose of providing an opportunity for the man engaged in research to present his work in detail to a sympathetic audience. The papers often have no obvious clinical application and are of interest only to the scientifically minded. The membership is small, and the attendance seldom more than 100. There is no discussion except for replies to questions from the floor. This kind of scientific paper has seldom found a welcome place on the program of any other national society, too many of the members of which do not

enjoy hearing discussions of this type of research. Furthermore, such papers occupy too much time for a general program. The Association for Research on the other hand, being made up of those alone who are interested, has proved a stimulating outlet for laboratory workers.

In 1896 there originated a society that later became the American Academy of Ophthalmology and Otolaryngology. Certain ophthalmologists and otolaryngologists, practicing west of the Mississippi, held an organization meeting in Kansas City. Dr. Adolph Alt of Saint Louis was elected first president. This society was there named the Western Ophthalmological, Otological, Laryngological, and Rhinological Association. For some years western and southwestern members were in the great majority, but thereafter the popularity of the society waxed and many from other regions joined the group. It was then, and has always remained, a society with the special purpose of appealing to the younger men of the nation.

In 1910, at a meeting in Cincinnati, the name was changed from the Western Ophthalmological, Otological, Laryngological, and Rhinological Association to the American Academy of Ophthalmology and Otolaryngology.

Dr. Second Large, comptroller for many years, suggested the idea of postgraduate instruction courses during the meetings. In 1921, at the meeting in Philadelphia, the first section of the Postgraduate Instructions was announced as a part of the annual program. It took the present form in 1927. There were 37 demonstrators at the first courses in 1921. Motion pictures illustrative of operative and other procedures were first shown in a distinct unit in 1932. Prior to this time motion pictures were used only in conjunction with the presentation of papers.

The American Academy of Ophthalmology and Otolaryngology has instruc-

tion for its basis. Its main purpose is to disseminate as much pertinent information to ophthalmologists and otolaryngologists as can be condensed into a five-day program. Work is the keynote of these five days.

Unlike the American Ophthalmological Society and the Section on Ophthalmology, meetings are held all day long and every evening except for two evenings of entertainment. The outstanding feature is the courses of instruction. These are each from an hour to an hour and a half in length and are presented by an expert in the particular subject. Over 100 courses have been given each year for a number of years. Four mornings are usually occupied by these courses. Almost all are crowded by members and guests. Most of the instruction is to small groups of from 15 to 20. As soon as the young ophthalmologist has been certificated by the American Board of Ophthalmology, he is eligible to membership in the Academy, and most of these young men join this society.

The first available list of members appeared in the bound volume of the Transactions of the American Academy of Ophthalmology and Otolaryngology for 1903. At that time there were 169 members. This number has now increased to 3,526.

The latest undertaking of the Academy has been the establishment of correspondence courses. These immediately became popular and annually serve more than 300 members or ophthalmologists and otolaryngologists not yet eligible to membership. They are designed especially for the ophthalmic and otolaryngologic residents in hospitals in which systematic instruction is not given. Reading assignments are made, and are followed by written quizzes which are corrected by a staff of volunteer workers from the Academy membership. The value that these

courses have already proved is very great, and it is anticipated that after the war their importance will be far greater.

In 1913 the three then extant national ophthalmological associations appointed a joint committee for the purpose of forming an examining board for ophthalmology. Resulting from their efforts, the American Board of Ophthalmology, originally called the American Board of Ophthalmic Examinations, was formed.

At the outset nine members, three from each of the then functioning national societies, formed the Board. Later this number was increased to 12, 4 from each society. The organization meeting took place in Washington, D.C., on May 8, 1916.

This Board was the first of many specialty boards modelled after it, which have assumed an increasing importance in medical practice in the United States. A certificate from the American Board of Ophthalmology is indicative of efficiency in the medical and surgical care of the eye. Most medical schools require the certificate as a prerequisite for appointment to advanced instructorship. Each year an increasing number of men apply for these examinations. Over 2,000 ophthalmologists have already been certificated. A great stimulus was given by the special recognition granted by the Armed Forces to those certificated in ophthalmology. As a method of encouraging young men to better things in the practice of medicine, these boards have proved of inestimable value.

The examination usually consists in the submission of case reports, a written and an oral test occupying two days. Background, character, and ethics of the candidate are carefully considered. Such boards as these may well serve as models for other countries, but they must be impartially administered and entirely devoid of politics.

The foregoing presents a brief résumé



of our national ophthalmic organizations. In any complete discussion of ophthalmological societies in the United States mention should be made of the Pacific Coast Oto-Ophthalmological Society, which is an active organization in the western states functioning much as the American Academy of Ophthalmology and Otolaryngology, and of the specialty section of the Southern Medical Association that has a wide appeal among the doctors of

the south. Recently the eye section of the American College of Surgeons has become active and is unique in offering a three-day surgical program of considerable variety to its members.

Perhaps there are too many ophthalmological societies. But few attempt to attend them all, and their different characteristics permit each man to satisfy his own scientific appetite.

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## TENOTOMY OF THE RECTUS MUSCLES IN GLAUCOMA\*

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The causes of the initial rise of intraocular pressure in cases of chronic simple glaucoma are not well understood. Practically all our information regarding this disease and its pathology is of the terminal stages. In the fully developed case of glaucoma there are so many secondary changes that we have little help regarding the original causes. Most of the surgery for glaucoma is designed to reduce intraocular pressure by increasing the drainage of aqueous, so that most of our attention has been directed to this phase of the problem. It has been repeatedly demonstrated, however, that the peripheral anterior synechiae which impede the outflow of aqueous develop late and are not the initial cause of the increased tension, so there are undoubtedly other factors. While investigating some of these, we studied the effects of changing the arterial supply to the eye.

The intraocular pressure depends largely on the blood flow, as after death the tension rapidly falls. Temporary reduction of the arterial supply to the eye can be produced by the action of adrenalin<sup>1, 2</sup> on the blood vessels by retrobulbar

and subconjunctival injection. In cases of glaucoma, this causes a temporary reduction of intraocular pressure, apparently due to arterial constriction.

We considered various methods for more effective curtailment of the arterial supply, and one of us (R. K. L.) suggested tenotomizing the four recti. We were unaware that this had been tried before.<sup>3</sup> This operation releases the muscular pull of the recti and cuts off the anterior ciliary arteries that pass through the muscles. These vessels pass over the insertion of the tendons and penetrate the eyeball about 3 or 4 mm. from the limbus. They then anastomose with the long posterior ciliary arteries to form the major arterial circle of the iris, which supplies the ciliary body and iris. Probably the larger portion of this blood supply arises from the anterior ciliary vessels. After tenotomy of the recti, sufficient blood is apparently supplied by the long posterior arteries to the anterior part of the eye to prevent harmful effects. At all events, we did not observe any changes due to ischemia.

Studies have been made on the effect of the pull of the extraocular muscles on intraocular pressure. Parsons<sup>4</sup> commented

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on the effects of curare, which paralyzes the extraocular muscles and lowers tension. Schoenberg<sup>5</sup> tenotomized the eyes of rabbits and found that tension was lowered for a few days. Levinson<sup>6</sup> found that stimulation of the extraocular muscles raised intraocular pressure. None of these studies were done on glaucomatous eyes.

Tenotomy of the four recti produces exophthalmos, which is greatest immediately after operation but which diminishes somewhat in the following few weeks. The final amount of exophthalmos in our cases was 4 mm. in one and 3 mm. in the other case.

The muscles do not reattach in exactly the same relative position they held before operation, but do so with some irregularity, so that the position of the eyeball is turned, and, as a result there is a vertical or lateral tropia of 10 to 20 prism diopters. In our cases the eyes were blind, so there were no disturbing effects.

Within a week after tenotomy, motion of the eyeball is reestablished as the muscles become attached to the eyeball. The final range of motion is limited to approximately half of the normal.

The effect of tenotomy on the intraocular pressure is a substantial drop in pressure, which lasts about six weeks and is followed by a subsequent rise. This rise in pressure is possibly due to the development of new arterial channels, or dilatation of the old ones.

We performed two operations of this type. Both were in cases of absolute glaucoma in eyes that were blind and painful. The usual procedure of enucleation was offered the patients, but was refused in favor of any other procedure which would spare the eye.

In the first case there was a reduction of tension from over 70 mm. Hg (Schiötz) to 50 mm. This lasted six weeks, and was followed by a gradual

rise to 60 mm.; after three months the tension had returned to 70 mm.

In the second case, the tension could not be taken before operation, as the cornea was very irregular owing to extensive vesiculation, but every one who saw the patient agreed that the eye was stony hard. The cornea was gray and clouded so that the iris could not be seen through it. After operation, the corneal vesicles healed and the corneal surface became quite smooth. It had numerous opacities, but became transparent enough to permit a view of the iris. Tension could then be taken on this cornea, and was found to have fallen to 34 mm., at about which level it stayed for over six weeks, then rose to 40 mm. Hg, where it has stayed for the past three months. The patient was much relieved by this operation.

*Case 1.* R. K., a widow, aged 72 years. Diagnosis: Papillary carcinoma of the bladder with metastases, hypertension, arteriosclerotic heart disease, and bilateral glaucoma.

The patient was known to have had glaucoma in both eyes for 10 years. Seven years ago, at another hospital, iridectomy and cataract extraction were performed on the right eye. She was unhappy about the result of the operations, and refused surgery for the left eye, although it had been repeatedly urged. The left eye became blind about a year prior to admission. Pain had been recurring in it at intervals, but was very severe for three weeks before operation.

In the right eye, there was an operative coloboma of the iris superiorly. The pupil was drawn up, and there was a delicate secondary membrane. The fundus was seen through a haze. The disc was deeply excavated, the vessels dipping in at its edge. The arteries were narrowed; and indented the veins they crossed. There were no hemorrhages nor exudates. Vision with glasses was 5/200. The field of

vision was difficult to study as the vision and fixation were poor, but it was markedly contracted. Tension fluctuated between 22 and 34 mm. Hg.

The left eye was painful and congested. The cornea was steamy, with a small ulceration in the center. The eye was absolutely blind. Tension was over 70 mm., and stayed there despite all medication.

On June 24, 1943, the four recti of the left eye were tenotomized. There was moderate reaction postoperatively, but the pain was relieved soon after operation. Tension fell to 50 mm., and stayed at about that level for six weeks, then gradually rose to 60 mm., and a month later to 70 mm.

There was an exophthalmos of 3 mm., with a slight hypertropia.

*Case 2.* L. S., a housewife, aged 51 years, had had a history of diabetes mellitus for 21 years. Circulatory disturbances affected her extremities, so that a year prior to admission, a left mid-thigh amputation was done, and recently the right third toe had been removed.

In 1938, at another hospital, she had bilateral cataract extractions after preliminary iridectomies. This operation was followed by bilateral glaucoma that was thought to be secondary.

The right eye had an operative coloboma of the iris superiorly. The pillars of the iris were drawn upward into the wound. There was a secondary membrane through which only a fundus reflex could be seen, but no details. Vision with glasses was limited to counting fingers at 3 feet. Tension fluctuated between 20 and 30 mm. Hg, while the eye was under the influence of pilocarpine.

The left eye was painful and very congested. The cornea was gray and irregular, with many vesicles, and so clouded that it was opaque. The eye was stony hard, and tension could not be reduced by medication.

On November 15, 1943, an operation on the left eye was performed, consisting of tenotomy of the four recti. The local reaction was moderate, and the patient was relieved of pain and very grateful for the procedure. The corneal blebs flattened and the cornea became somewhat transparent so that the iris was visible, and a vague fundus reflex was obtained. Tension dropped to 34 mm. Hg, at which level it stayed for over six weeks, then gradually rose to 40 mm. It has stayed at this level for the past three months.

The left eye is in a slightly divergent position, with 4 mm. of exophthalmos, and a limited range of motion in all fields.

After we had performed these operations, it was discovered that the same procedure had been undertaken by Sapirov<sup>3</sup> in Russia. He had performed it in 43 cases of glaucoma of various types; acute, chronic, and absolute, primary and secondary. In all but three the tension fell 12 to 48 mm.; the maximum lowering occurred two to five days after operation. After a few months, tension returned to the preoperative level. Vision improved in some. His patients developed exophthalmos and a changed position of the globe. Those that had vision had diplopia. To avoid this, he tried cutting the central portion of the tendons only, and left 1 mm. attached on each side. However, this lessened the effect of the operation. He also diminished the diplopia as well as the exophthalmos by only tenotomizing two opposing muscles, such as the two laterals or the two verticals, but this also diminished the effect on the intraocular pressure. Partial effects were obtained by tying off the recti, or cauterizing them, thus closing the anterior ciliary arteries. He concluded that this operation is effective in obtaining temporary relief, and commented on its usefulness in a case of glaucoma associated with ulcerative blepharitis that would

have made intraocular operation dangerous. Our experience in the cases we have presented confirms the findings of Sapir.

#### SUMMARY AND CONCLUSIONS

An interesting approach to the study of glaucoma is offered by tenotomizing the four rectus muscles and curtailing the arterial supply to the eye. This procedure is followed by a temporary lowering of intraocular pressure. It also produces an exophthalmos of 3 to 4 mm. and a changed position of the globe.

The fall in tension is due partly to the release of the pull of the recti on the eyeball and partly to the interruption of the anterior ciliary arteries which pass through the muscles into the eyeball. After about six weeks, there is a return of higher pressure, probably due to the reestablishment of the circulation.

This is not offered as a definitive operative procedure, but as a method for further study. The operation may be useful in the blind eyes of absolute glaucoma, but is not advisable for an eye with vision.

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# THE ASSOCIATION BETWEEN RETINOPATHIES AND ENCEPHALOPATHIES IN THE COMMON CARDIO-VASCULO-RENAL AFFECTIONS\*

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That a close relationship must of necessity exist between the eye and the brain, due to their common inception and blood supply, cannot be denied. However, the many factors that produce changes and the reaction to them are somewhat different in the two organs. For instance, the greater size of some of the vessels of the brain, having no counterpart in the eye, may cause them to become involved by certain conditions that rarely affect the retinal vessels. Investigators who endeavored to ascertain the value of the fundus as a diagnostic means of determining the condition of the blood vessels of the brain, the kidneys, or the general system, after having compared their ophthalmoscopic observations with the pathologist's findings at the autopsy, report quite different conclusions. However, we must not lose sight of the fact that large and small vessels and capillaries are affected differently, even in the same tissue and in the same area. If this is remembered, one can state with less chance of error, upon observing the fundus of the eye, that the brain or the parenchyma of the kidney may be involved, at least in part, in a similar manner. Those affections which primarily involve the same caliber of vessels in the retina, the brain, and the kidney behave in a remarkably similar manner.

## ARTERIOSCLEROSIS

The basis for most of the vascular changes in the eye and brain is a sclerosis of the blood vessels. There are many

classifications of sclerosis, but the chief and the common types are: (1) the atherosclerotic changes of the arteries, and those conditions resulting from (2) hypertension, and (3) arteriolar sclerosis.

*Atherosclerosis* is primarily a fibrous and hyaline degeneration of the muscular media. The intima may be affected secondarily by fatty deposits and endothelial-cell proliferation. This may lead to thrombosis and occlusion of the lumen of the vessel. In the eye the arteries show an increased light reflex, moderate arteriovenous constriction, and some beading or white sheathing of the vessels near the disc. This is a very common form of sclerosis and is one of the senile changes that occurs throughout the body, although it is not necessarily distributed evenly as to its severity. The moderate form is symptomless and is independent of increased blood pressure (fig. 1).

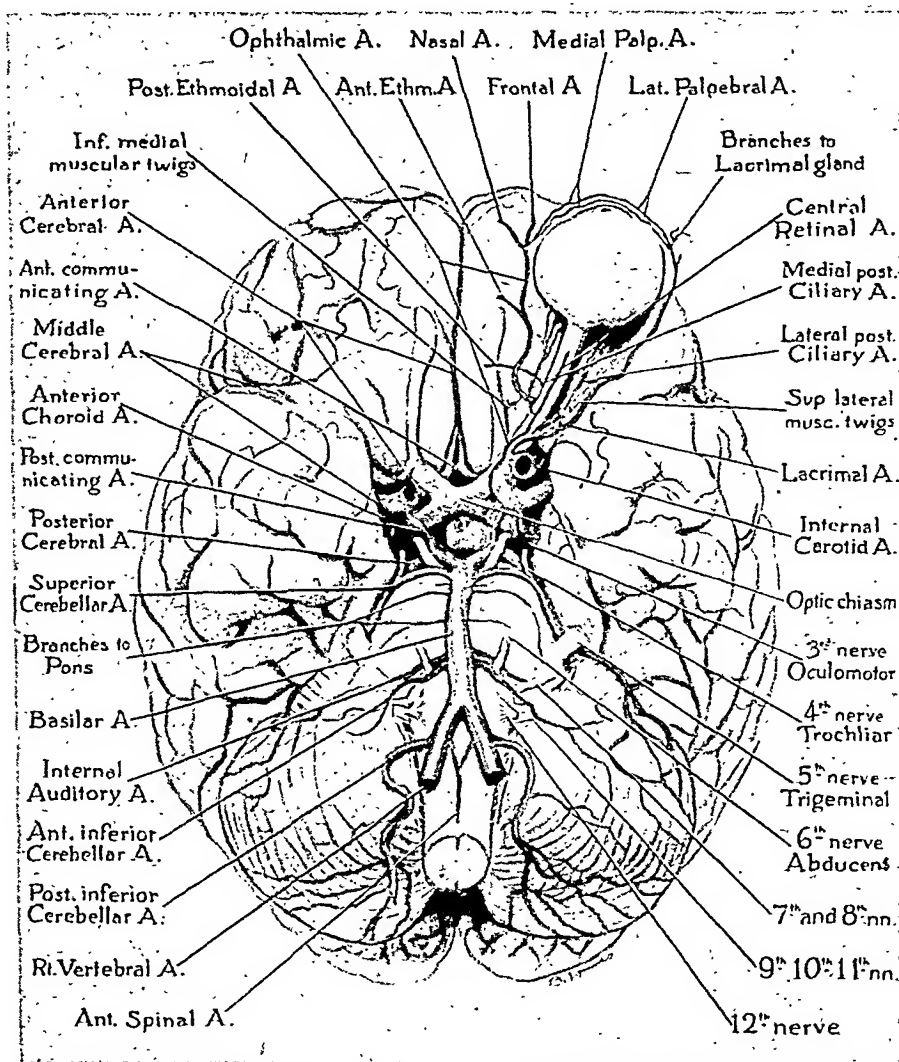
*Hypertension* of the essential or benign type without arteriosclerosis is entirely possible. It may be symptomless, especially as regards vision. It may be due to an infection, a toxin or poison, or to a metabolic or endocrine disturbance which produces a tonic contraction of the vessel walls and which, if eliminated in time, may be of no consequence. If however, the causative agent is allowed to remain and the increased tension continues, an arteriosclerosis may develop which, owing to the influence of the increased blood pressure, may produce changes in the walls of the blood vessels and ultimately affect the tissues supplied by these vessels. In the eye the arterial network then becomes constricted. The larger arteries are

\* Candidate's thesis for membership in the American Ophthalmological Society accepted by the Committee on Theses, June, 1943.

mere straight threads branching at acute angles, and the small vessels are invisible (fig. 2). Sheathing of the vessels appears. Later, exudates and hemorrhages may produce an arteriosclerotic retinosis.

*Arteriolar sclerosis*, the third type, affects retinal arteries of all sizes but

velops, with widened light reflexes, arteriovenous constriction, and sheathing of the vessels. In the arterioles and capillaries the walls are thickened, and the lumen may close altogether. Later, hemorrhages and exudates, and finally a papilledema, with edema of the retina,



Arteries of the brain and eye. Basal view.

more especially the smaller arterioles whose visibility and tortuosity are increased (fig. 3). The musculature of the larger vessels, the subendothelium, and the elastic tissue are affected with constriction of the lumen to the point of obliteration. At first, however, in the larger vessels, irregular tortuosity de-

may appear, especially if a toxemia is present. At this stage the arteries are narrowed, especially if the condition is superimposed upon a benign or essential hypertension that has existed for some time. Occasionally the toxic manifestations of edema appear in a normal fundus, as in acute toxemia of pregnancy and in

## Figs. 1-10 (Lyle). Retinopathies.



Fig. 1. Early retinal arteriosclerosis.



Fig. 3. Arteriolar sclerosis.

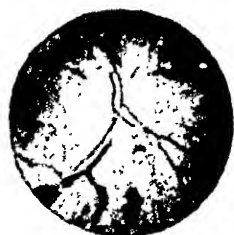


Fig. 4. Arteriosclerotic retinosis.

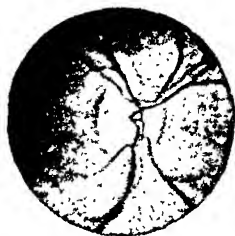


Fig. 5. Diabetic retinosis.



Fig. 7. Diabetic retinosis with marked hemorrhages.



Fig. 8. Malignant hypertension with nephrosclerosis.



Fig. 9. Retinopathy from glomerulonephritis.

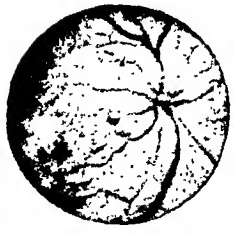


Fig. 10. Malignant hypertension with edema of retina and papilla.



lead poisoning. If toxic disturbances are added to arteriosclerosis and hypertension, the retinopathies of arteriosclerotic malignant hypertension, renal and diabetic affections, are produced.

Of these conditions, the arteriosclerotic (fig. 4) and the diabetic (fig. 5) types are usually free from edema, the vessels show advanced arteriosclerotic changes, and the hemorrhages are generally small. In some cases, however, both in the arteriosclerotic (fig. 6) and in the hemorrhagic type of diabetes (fig. 7), hemorrhages may be relatively large and profuse. The exudates are usually small, and present a hard appearance, with sharp edges. Many observers believe that diabetic retinosis is merely an arteriosclerotic retinosis occurring in a diabetic. This is borne out by the fact that retinal changes are seldom found in the juvenile diabetic and are most frequent in the diabetic with arteriosclerosis. There is no doubt but that diabetes predisposes to arteriosclerosis and thrombosis and that arteriosclerosis is more common in diabetes (fig. 7). Every observer who has studied the subject has been impressed by the fact that a pure isolated retinopathy is quite rare. The retinopathy is a combination of arteriosclerosis, hypertension, and toxemia of renal, diabetic, or other sources. One may, at best, determine the principal, primary, or dominant factor.

The retinopathies of malignant hypertension (fig. 8) with nephrosclerosis and glomerulonephritis (fig. 9) are characterized by edema of the retina and papilla (fig. 10) with soft, fluffy exudates and hemorrhages, which may be extensive, and narrow, attenuated arteries. Charts 1 and 2 list a series of such cases, together with their cardio-vasculo-renal conditions.

Arteriosclerosis in the brain, as in the retina, commonly produces atherosclerosis

and arteriolosclerosis. Atheromatous vascular sclerosis occurs frequently in the cerebral arteries. It is found almost constantly in the aged. In patients of advanced years difficulty is experienced in determining whether the sclerosis is a true arteriosclerosis or a senile degeneration. However, aging of the vessels is surely one of the causes of arteriosclerosis together with degenerative changes pro-

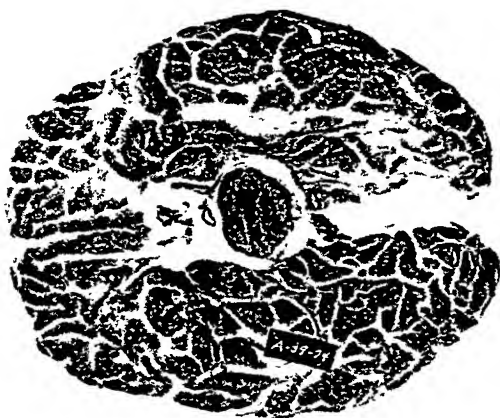


Fig. 11 (Lyle). Thrombosis of left posterior cerebral artery and marked arteriosclerosis of vessels at base of brain.

duced by toxins, infections, and the like. The common findings in cerebral atherosclerosis are hyalinization of the arterial walls, proliferation of the intima, fatty degeneration and calcification, narrowing or widening of the lumen, endarteritis or periarteritis, and splitting or increase of elasticity. In the senile the elasticity is lost, and connective and glial tissue develops evenly, or unevenly in the form of plaques.

Figure 11 (A 39—74) shows the base of the brain of a man, aged 68 years, who was found to have a marked retinal arteriosclerosis and a right homonymous hemianopia. His blood pressure was 142/97. The vessels at the base of the brain showed marked atheromatous changes. A thrombosis of the left pos-

## CHART 1

AUTOPSIES PERFORMED ON HYPERTENSIVE CASES.—PRIMARYLY SCLEROTIC—SECONDARILY NEPHRITIC

Case—Age	Retina	Blood Pressure	Heart (Aorta)	Kidneys	Urine
1. F. C. (31-525) m-	Arteriosclerosis, marked. Retinal edema. Papilledema—slight.	Not available	Myocardial fibrosis and edema. Coronary arteriosclerosis.	Arteriolar nephrosclerosis advanced.	Alb. +
2. H. D. (32-124) m-	Arteriolar sclerosis. Old scars and hemorrhages. Papilledema.	190/130	Myocardial fibrosis. Arteriosclerosis—early aortitis.	Arterio- and arteriolar nephrosclerosis.	Alb. +++
3. A. H. (32-543) m-	Arteriolar sclerosis. Retinal exudates numerous. Papilledema marked.	210/38 also 176/136 (earlier)	Myocardial fibrosis. Atherosclerosis. General arteriosclerosis.	Arterio-nephrosclerosis advanced	Alb. ++++
4. M. S. (32-569) m-	Arteriolar sclerosis, marked. Retinal hemorrhages and scars numerous. No papilledema.	210/140	Cardiac hypertrophy and dilatation.	Arterio-nephrosclerosis. Subacute glomerulonephritis.	..
5. T. M. (32-129) m-	Arteriolar sclerosis, marked. Retinal exudates. Papilledema of left eye	..	Myocardial hypertrophy. Edema. General arteriosclerosis.	Toxic nephrosis extreme. Hydronephrosis with cyst.	Sugar trace
6. W. K. (32-482) m-	Arteriolar sclerosis, marked. Many hemorrhages and exudates. Papilledema.	230/180	Hypertrophy and dilatation. Edema. General arteriosclerosis.	Arteriolar nephrosclerosis. Terminal acute pyelonephritis.	Alb. +++ Sugar trace
7. J. F. (30-609) m-	Marked sclerosis. Papilledema.	Not obtained	Myocardial edema and fibrosis. Generalized arteriosclerosis.	Arterio-nephrosclerosis.	..
8. C. B. (31-413) m-	Slight papilledema.	..	Myocardial fibrosis. General arteriosclerosis.	Arterio- and arteriolar sclerosis. Advanced.	Alb. + Blood urea 75.
9. M. A. (31-68) f-24	Arteriolar sclerosis, marked. Retinal hemorrhages and exudates—numerous, old and recent.	220/130	Toxic myocardiosis. Atherosclerosis of aorta.	Arteriolar nephrosclerosis, marked, far advanced. Toxic nephrosis.	Alb. ++++
10. G. McC. (32-466) m-	Arteriolar sclerosis, marked. Papilla pale and indistinct.	130/70	Myocardial fibrosis. Atherosclerosis, coronary. Generalized arteriosclerosis.	Arteriolar nephrosclerosis.	Alb. Neg. Sugar Neg.
11. C. G. (32-323) f-55	No hemorrhages or exudates. Discs very white. Papilledema.	180/100	Diffuse myocardial degeneration and fibrosis and hypertrophy. Advanced coronary and general arteriosclerosis.	Arterio- and arteriolar nephrosclerosis.	Alb. trace
12. G. W. (31-236) f-37	Arteriolar sclerosis, marked. Retinal exudates. No hemorrhages. Papilledema.	240/170	Toxic myocardiosis. Hypertensive heart. Aneurysm of aorta. Generalized arteriosclerosis.	Arterio-nephrosclerosis (early)	Alb. +++
13. A. C. (31-336) f-	Arteriolar sclerosis, marked. Many hemorrhages and exudates.	..	Generalized arteriosclerosis.	Arterio- and arteriolar nephrosclerosis.	..
14. S. J. (32-663) m-	Arteriolar sclerosis, marked. Small diffuse hemorrhages.	..	Myocardial fibrosis. Generalized arteriosclerosis. Coronary sclerosis.	Arterio- and arteriolar nephrosclerosis.	Alb. +
15. M. S. (34-105) f-63	Arteriolar sclerosis.	200/85	Heart block. Advanced myocardial degeneration and dilatation. Aortic arteriosclerosis.	..	Alb. +
16. F. O'R. (34-86) m-53	Papilledema (bilateral).	..	Myocardial fibrosis. Atherosclerosis of the aorta.	Chronic passive congestion.	Sugar +
17. W. G. (34-99) -74	Arteriolar sclerosis (marked).	270/140	Myocardial hypertrophy and fibrosis. Arteriosclerosis.	Chronic passive congestion.	..
18. T. D. (32-78) m-48	Advanced hemorrhagic and exudative retinitis. Papilledema.	240/150	Hypertrophy; myocardial. Atherosclerosis coronary.	Chronic glomerulonephrosis. Marked arteriolar nephrosclerosis.	Alb. +++
19. F. E. (33-52) m-60	Arteriolar sclerosis.	190/110	Atherosclerosis of the aorta and coronary. General vascular sclerosis.	Chronic passive congestion.	Alb. +

## CHART 1

AUTOPSIES PERFORMED ON HYPERTENSIVE CASES.—PRIMARYLY SCLEROTIC—SECONDARILY NEPHRITIC

<i>Meninges</i>	<i>Vessels</i>	<i>Convulsions</i>	<i>Sutures</i>	<i>Appearance</i>	<i>Weight</i>	<i>Spinal Pressure</i>
Thick at base.	Markedly sclerotic. Atheromatous.	Flat.	Narrow.	General arteriosclerosis. Soft and flabby. Edema.	1,440	..
Dura thick. Pia edematous.	Appear normal.	Flat.	Narrow.	Pale—edematous.	..	..
Normal.	Slight congestion. No plaques.	Very flat.	Hardly noticeable.	Arteriosclerosis, edema and congestion.	1,635 g.	26 cm.
Normal.	Moderate congestion. Permanent vascular markings.	Moderately flat.	Narrow.	Edema and congestion. Marked. Hemorrhage occipital lobe; softening.	1,330 g.	Nothing unusual.
Pia thick. Chronic leptomeningitis.	Engorged.	..	..	Edema. Early internal hydrocephalus.	..	Increased subarachnoid fluid especially at base.
No head permission			..	..	..	..
Normal.	Injected. Subarachnoid and right frontal hemorrhages.	Flat.	Narrow.	Hemorrhage and edema.	1,175	..
Normal.	Engorged.	..	..	Edema.	1,325	..
No head permission					1,240	
Normal.	Atheromatous plaques in Circle of Willis. Vessels not engorged.	Narrowed.	Widened.	Encephalitis in frontal lobe. Right ventricular nucleus soft.	..	Increased subarachnoid fluid.
No head permission						No tap.
No head permission						34 cm.
Dura adherent. Pia thick.	General sclerosis and hyalinization all vessels.	..	Thrombosis, middle cerebral artery	Multiple areas of degeneration. Encephalomalacia.	..	..
Dura, petechial hemorrhages. Marked subarachnoid fluid.	Arteriosclerosis, marked.	Atrophic.	..	Cortical atrophy and general arteriosclerosis.	1,030	..
Nothing abnormal.	Slightly congested.	Flattening.	Narrowing.	Edema.	1,135	No tap.
Pia thick at base.	Cerebral arteriosclerosis, blood subarachnoid.	Flattened. Softening at base.	Narrowed.	Edema. Encephalomalacia. Rel. hydrocephalus.	1,550	..
Chronic leptomeningitis.	Hemorrhage into pons and medulla.	Flattening.	Narrowed.	Softening and hemorrhage at junction of pons and medulla.	1,335	No tap.
Negative.	Cerebral hemorrhages.	Flattened. Marked.	Narrowed.	Softening basal nuclei, also hemorrhage.	..	..
Pia thickened.	Cerebral arteriosclerosis. Atherosclerosis.	Flattened.	..	Congestion and edema. Softening right frontal and parietal lobes.	1,300	..

CHART 1—Continued

Case—Age	Retina	Blood Pressure	Heart (Aorta)	Kidneys	Urine
20. L. E. (33-63) m-57	Arteriolar sclerosis.	190/50	Myocardial hypertrophy, fibrosis and dilatation. Aortic atherosclerosis.	Chronic passive congestion.	..
22. C. E. (30-204) m-47	Retinal exudates (numerous). Papilla blurred.	210/132	Interstitial edema of myocardium. Syphilitic aortitis.	Arteriolar nephrosclerosis (far advanced).	Alb. ++ U.N. 24 43 30
23. D. B. (30-177) f-50	Retinal exudates (numerous). Papilla blurred.	134/78	Toxic myocarditis. Moderate sclerosis.	Arteriolar nephrosclerosis and toxic nephrosis.	Alb. --
24. H. K. (30-218) f-42	Arteriosclerosis advanced. Retinal exudates and hemorrhages. Papilledema.	150/100	Chronic sclerotic valvular endocarditis. Toxic myocarditis. Marked coronary sclerosis.	Arterio- and arteriolar nephrosclerosis. Far advanced.	Alb. ++ U.N. 86 to 188
25. M. T. (29-623) f-45	Retinal exudates and hemorrhages. Papilledema.	300/200	Diffuse myocardial fibrosis. Cardiac hypertrophy. Early aortic atherosclerosis.	Arterio- and arteriolar nephrosclerosis. advanced.	Alb. + + + +
26. L. B. (28-332) f-46	Papilledema.	234/128	Subacute fibrous pericarditis.	Arterio- and arteriolar nephrosclerosis. Far advanced.	Alb. + + + +
27. H. H. (29-555) m-59	Arteriolar sclerosis. Retinal hemorrhages. Papilla "obscured." Conjugate deviation to right.	..	Myocardial degeneration with fibrosis and hypertrophy. Atherosclerosis of aorta.	Arterio- and arteriolar nephrosclerosis, chronic.	..
28. D. F. (30-28) m-65 <sup>1</sup>	Arteriolar sclerosis. Papilledema.	210/96	Myocarditis (chronic). Pericarditis (chronic). General arteriosclerosis.	Arteriolar nephrosclerosis (advanced).	Alb. +
29. U. K. (29-229) m-	Arteriolar sclerosis. Retinal hemorrhages. Papilledema.	160/55	Myocardial degeneration. Atheromatous aortic changes.	Arteriolar nephrosclerosis.	Negative
30. M. J. (29-55) m-40	Arteriolar sclerosis. Many old retinal scars. Papilledema marked. Conv. dev.	300/180	Diffuse myocardial fibrosis. Coronary sclerosis. Generalized arteriosclerosis.	Arteriolar nephrosclerosis (advanced).	..
31. L. G. (29-76) f-39	Many retinal exudates. Papilledema.	300/165 to 290/165	Myocardial degeneration. Interstitial cardiac edema.	Arterio- and arteriolar nephrosclerosis, chronic—marked.	..
32. H. L. (M.9103) m-52	Arteriolar sclerosis. Exudates—few, small. Papilledema.	..	Fibrosis myocarditis. Hypertension and dilatation. Sclerosis and dilatation of aorta.	Arteriolar nephrosclerosis, chronic and far advanced.	Alb. ++
33. S. D. (29-404) f-31	Five months pregnancy. Papilledema.	98/60	Edema of myocardium.	Not remarkable.	Alb. —
34. R. G. (30-26) m-30	Arteriolar sclerosis. Retinal hemorrhages. Malignant hypertension. Papilledema.	204/146	Fibrinous pericarditis.	Advanced arteriolar nephrosclerosis. Glomerulo-nephritis, chronic.	Alb. + + + +
35. U. N. (26-310) m-	Arteriolar sclerosis. Papilledema.	210/120	Chronic myocardial hypertrophy fibrous degeneration.	Nephrosclerosis, chronic vascular nephrosis.	..
36. C. M. (27-177) f-54	Eyes turn upward. Papilledema.	None recorded.	Chronic myocarditis, coronary sclerosis.	Arterio-nephrosclerosis (early). Toxic nephrosis	Alb. + + + +
37. M. P. (26-404) f-80	Retinal hemorrhages. Conjugate deviation to right.	Not recorded.	Myocardia fibrosis. Chronic endocarditis.	Chronic vascular nephrosis.	Not recorded.
38. U. C. (27-140) m-45	Arteriolar sclerosis. No hemorrhages or exudates. Papilledema.	210/130	No record.	..	Negative.
39. M. L. (27-156) f-60	Arteriolar sclerosis. Retinal edema. Papilledema. Conv. dev. to left.	290/140	Myocarditis. Myocardial insufficiency. Atheroma of aorta.	Arteriolar nephrosclerosis (advanced).	Alb. +
40. A. W. (28-425) f-32	Retinal hemorrhages. Papilledema.	172/95	Congestion.	Slight arteriosclerosis of kidneys.	Alb. + Sugar + + + +
41. W. J. (M-25-12) m-	Arteriosclerosis. Retinitis. Vessels markedly sclerotic. Papilledema.	190/118 to 235/150	Hypertrophy. Aortic thickening. General arteriosclerosis.	Chronic vascular nephritis. Renal edema.	Alb. + + + U.N. 50

CHART 1—Continued

<i>Meninges</i>	<i>Vessels</i>	<i>Convulsions</i>	<i>Sutures</i>	<i>Appearance</i>	<i>Weight</i>	<i>Spinal Pressure</i>
Negative.	Thickened. Many plaques.	..	..	Congestion.	1,360	..
No head permission			..	..	..	..
Appear normal.	Moderate congestion. Basal atheromatous changes.	Moderately flattened.	Narrowed.	Edema. Congestion moderate.	..	..
Not remarkable.	Slight atheromatous changes.	Flattened.	Narrowed.	..	..	..
No head permission			..	..	..	Negative.
No head permission			..	..	..	..
Normal.	Cerebral hemorrhage. Cerebral arteriosclerosis.	Flattened.	Narrowed.	Edema. Intraventricular hemorrhage.	..	No pressure.
No head permission			..	..	..	..
	Subdural and pial hemorrhage. Cerebral arteriosclerosis.	Narrowed.	Narrowed.	Edema and softening.	1,350	22 cm. Bloody.
...	Hemorrhage into brain and meninges, multiple.	..	..	Softening. R. int. caps and r. motor area. Clot in r. ventricle.	..	Greatly increased.
Dura thickness.	Marked engorgement.	..	..	Softening—hemorrhage. Marked pons hemorrhage.	..	Marked increase.
Pia thickened.	Sclerotic thick arteriosclerosis.	Not remarkable.	..	..	14,159	30 cm.
Dura negative. Pia thick and granular.	Congestion.	Narrowed.	Narrowed.	Softening, acute perivascular inflammation. Edema.	15,509	Cloudy. Gray. 1,200 polys.
No head permission			..	..	..	Increased.
..	No head permission		..	Cerebral hemorrhage.	..	Bloody.
Dura smooth, glistening.	..	..	..	..	..	25 cm.
Sub-arachnoid hemorrhage.	Blood around base of brain. Parietal area.	..	..	Blood in lateral ventricles.	..	Not measurable. Bloody.
Sub-arachnoid hemorrhage.	Circle of Willis plaques and sclerosis.	Flattened.	..	Blood in ventricles.	14,309	Bloody.
..	No head permission		..	..	..	..
Pia at base thickened.	Engorgement.	..	..	Softening. Hemorrhages in lateral ventricles.	..	Increased pressure.
Edematous.	Congested arteriosclerosis degeneration of vessel walls.	Flattened.	Narrowed.	Edema.	13,659	25 cm.

## CHART 2

AUTOPSIES PERFORMED ON HYPERTENSIVE CASES.—PRIMARY NEPHRITIC—SECONDARILY SCLEROTIC

<i>Case—Age</i>	<i>Retina</i>	<i>Blood Pressure (Average)</i>	<i>Heart (Aorta)</i>	<i>Kidneys</i>	<i>Urine</i>
1. I. M. (33-329) f-13	Retinal detachment. Retinal hemorrhage. Papilledema.	235/160	Myocarditis, hypertension. General arteriosclerosis.	Glomerulonephritis. Superimposed pyelonephritis.	Alb.+++
2. J.W. (32-505) m-21	Many flame-shaped hemorrhages and exudates. Papilledema.	170/116 256/134	Left ventricular hypertrophy. Chronic myocarditis and degeneration.	Glomerulonephritis (chronic) 3d stage with arterionephrosclerosis.	Alb.+++
3. A. D. (32-268) f-38	Numerous hemorrhages. Papilledema.	250/170	Advanced myocardosis. Aorta dilated. Atherosclerosis.	Glomerulonephritis (chronic). Arteriolar nephrosclerosis.	Alb.+++ Urea 40
4. P. T. (31-295) f-	Arteriolar sclerosis, moderate. No exudates or hemorrhages. Papilledema.	150/100	Toxic myocardosis. Early aortic atherosclerosis.	Glomerulonephritis (acute and sub-acute). Toxic nephrosis.	Alb.++++
5. L. S. (31-303) f-	Arteriosclerosis, marked. Papilledema, moderate.	158/90	Toxic myocardosis. Early atherosclerosis. General arteriosclerosis, early.	Pyelonephritis (chronic extensive) with hydronephrosis.	Alb.++++
6. B. M. (30-429) m-36	Arteriosclerosis. Retinal hemorrhages and exudates. Papilledema—marked.	204/142	Diffuse myocarditis. Atherosclerosis of aorta. General arteriosclerosis, marked.	Glomerulonephritis (chronic). Arteriolar nephrosclerosis far advanced.	Alb.+++
7. E. P. (30-422) m-26	Arteriolar sclerosis, marked. Retinal exudates. Discs obscured by exudates.	122/76	Fine myocardial fibrosis. Marked arteriosclerosis of aorta. General arteriosclerosis.	Acute pyelo-nephrosclerosis. Arteriolar nephrosclerosis with glomerulosclerosis.	Alb.+++
8. T. A. (32-599) m-45	Most vessels buried or destroyed. Many new and old hemorrhages. Papilledema.	240/160	Hypertension. Fine diffuse myocarditis. Atherosclerosis, aorta and coronary.	Glomerulonephritis (chronic). Arteriolar sclerosis. Far advanced arterionephrosclerosis.	Alb.+
9. J. H. (30-167) m-61	Papilledema marked.	258/120	Myocardial hypertrophy.	Glomerulonephritis (chronic) with superimposed acute pyelitis. Arteriolar nephritis.	Alb.++++
10. B. S. (30-236) f-29	Retinal exudates and hemorrhages—numerous. Papilledema.	250/160	Chronic focal pericarditis. Hypertrophy left ventricle.	Glomerulonephritis (chronic) arteriolar nephrosclerosis.	Alb.+++ U.N. 150 188
11. A. N. (28-358) f-21	Retinal exudates and hemorrhages. Papilledema.	..	Pericarditis.	Pyelonephritis (chronic) Arteriolar nephrosclerosis.	Alb.+++ U.N. 292
12. E. W. (29-133) f-59	Retinal detachment. Retinal "scars." Papilledema.	134/56	Hypertension. Myocardial fibrosis and dilatation.	Focal nephrosclerotic.	Alb.+++
13. B. V. (28-517) f-43	No hemorrhages or exudates. Papilledema—marked.	..	Endocarditis.	Glomerulonephritis (subacute) far advanced.	Alb.++ U.N. 255
14. G. A. (30-70) m-59	No hemorrhages. Papilledema.	148/80	Toxic myocarditis. Atherosclerosis of aorta.	Polycystic (advanced). Interstitial nephritis, chronic.	No work
15. W. H. (29-16) m-39	Retinal exudates and hemorrhages, numerous. Papilledema.	210/130	Hypertrophy of left ventricle. Edema of the heart.	Glomerulonephritis, chronic and acute cystic degeneration.	Alb.+++
16. E. B. (27-338) f-21	Papilledema slight. Arteriolar sclerosis. Retinal edema.	175/100	Myocardium and arteries show thickening. Fibrous and degenerative hypertrophy. Toxic myocarditis.	Vascular nephritis, chronic, far advanced	Alb.++++
17. W. F. (30-282) m-34	Retinal exudates and hemorrhages.	210/120	Toxic myocarditis.	Glomerulonephritis, advanced. Arteriolar nephrosclerosis. Pyelonephritis.	Alb.+++
18. E. B. (36-33) f-	Retinal hemorrhage and exudates. Retinal edema. Papilledema.	245/145 Post-operative 160/ to 190	Atherosclerosis of aorta.	Arterio-nephrosclerosis.	Alb.+++

## CHART 2

AUTOPSIES PERFORMED ON HYPERTENSIVE CASES.—PRIMARY NEPHRITIC—SECONDARILY SCLEROTIC

<i>Meninges</i>	<i>Vessels</i>	<i>Convulsions</i>	<i>Sutures</i>	<i>Appearance</i>	<i>Weight</i>	<i>Spinal Pressure</i>
No head-permission			..	..	..	-24 mm.
Normal.	Moderately congested.	Flattened.	Narrowed.	..	1,700 g.	Slight increase.
Dura tense.	Appear congested.	Flattened.	Narrowed.	Edema and general pal-lor. Anemia.	1,210	No increase.
Dura taut.	Moderately congested.	Flattened.	..	Edema.	..	No tap.
No head permission			..	..	..	No tap.
No head permission			..	..	..	No tap.
Dura normal. Pia cloudy at base.	..	Flattened superiorly.	..	..	1,295 g.	Not given. No increase in fluid.
Normal.	Moderate arteriosclerosis.	Flattened.	Narrowed.	..	1,180	32 cm.
Normal.	Nothing abnormal.	Flattened.	Narrowed.	Edema—wet.	1,215	No tap.
Not complete			..	Edema.	..	No tap.
No head permission			..	..	..	No tap.
Normal.	Venous engorgement.	Not remark-able.	..	..	..	..
..	..	Flattened.	..	Edema.	..	Increased greatly.
Congestion and thick pia.	Generally thick and plaques.	Flattened.	..	Edema, congestion.	1,215 g.	..
No head permission			..	Uremia.	..	13 cm.
No head permission			..	..	..	30 cm.
Normal.	Slight congestion.	..	Narrowed	Edema, congestion.	1,275 g.	Very high.
Normal.	..	..	..	No edema. Very pale.	1,140	..





Fig. 12 (Lyle). Atheromatous changes best seen in the basilar artery.

terior cerebral artery had produced a softening of the temporal and occipital lobes, with implication of the left visual cortex and optic radiations.

Figure 12 (N 36—71) shows the brain of a man, aged 80 years, with marked atheromatous changes best seen in the basilar artery. The pons shows an area of softening from a thrombosis of a small pontine vessel from the basilar artery.

In the aged and the arteriosclerotic, as the nourishment to the brain is reduced, shrinking of the tissues occurs. The convolutions are rounded and separated by widened fissures through which sclerotic vessels pass. Lacunae, or spaces, usually miliary in size, form in the tissue of the

brain. They have an analogy in the senile spaces found in the retina of the eye. Because of the shrinkage of the brain tissue, the ventricles become enlarged so that a compensatory hydrocephalus develops as is demonstrated in the brain section, figure 13 (N 28—195). This man, aged 85 years, had a marked cortical atrophy.

Arteriolosclerosis in the brain is found in the arterioles and

capillaries, most frequently in the cortex, nuclei, and medulla. Hyalinization of the walls is produced in the intima and the media. The adventitia may be affected later.

Other arteriosclerotic conditions, both in the brain and in the retina, such as capillary fibrosis, endarteritis, and calcification, are relatively rare and will merely be mentioned here.

#### HYPERTENSIVE ENCEPHALOPATHY AND RETINOPATHY

Hypertensive encephalopathy with retinopathy is an acute or subacute, probably toxic, circulatory disturbance of the brain and retina which occurs usually with high blood pressure. Hypertensive states in the acute form may occur with-

out the presence of arteriosclerosis. Examples of this are found in the toxemia of pregnancy and in lead poisoning. However, the more common subacute types usually have an advanced arteriosclerotic background, more marked in the primary sclerotic and less marked in the primary glomerulonephritic types of hypertension.

The inciting factors of malignant and nephritic hypertensive states are not clearly understood. Constriction of the arterioles and capillaries and proliferation in their walls may play a part. Pathologic changes are not constant. The commonest cerebral



Fig. 13 (Lyle). Senile sclerotic brain with compensatory hydrocephalus.

and retinal symptoms are due to the edema, which in the brain produces an increased intracranial pressure. The production of this edema is due to the vascular and circulatory changes, to which are added the toxic factors of remote and local disturbed metabolism.

In the brain and the retina edema and hemorrhages are present. The papilledema may be so marked as to present the appearance of a choked disc (fig. 14). If the vascular system is chiefly involved, arteriosclerotic retinosis, or at least a marked

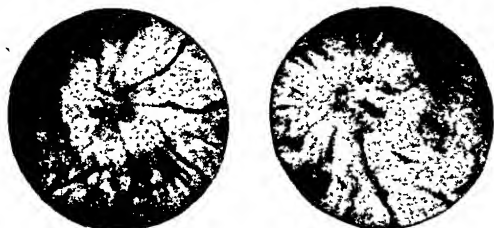


Fig. 14 (Lyle). Marked papilledema in malignant hypertension.

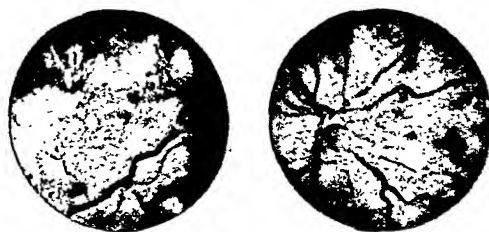


Fig. 15 (Lyle). Marked retinal and papilledema in glomerulonephritis.

retinal arteriosclerosis, is present. If glomerulonephritis is prominent, the fundus has the appearance of a renal retinosis (fig. 15). However, as is definitely shown by a study of the accompanying charts, both conditions are usually present, one generally preceding and dominating the other. Charts 1 and 2 comprise a series of autopsies of hypertensive cases that exhibited marked retinal changes which were studied and recorded clinically. The chief areas of interest were charted;



Fig. 16 (Lyle). Basal view of brain of case of malignant hypertension.

namely, the cranial contents, the heart and kidneys, to which were added the blood pressure and the urinary and spinal-fluid findings.

In both the primary arteriosclerotic and glomerulonephritic types, the heart was found to show degenerative or inflammatory changes. The kidneys were found to be the seat of vascular nephrosclerosis or glomerulonephritic degeneration or both, one more pronounced, depending upon the type. In most cases there was an increased intracranial pressure which was, in some cases, determined before death by spinal-fluid pressure. The brain was, with very few exceptions, edematous—the so-called "wet brain." The con-



Fig. 17 (Lyle). Section of same brain showing edema and hemorrhage into ventricle.

volutions were flattened against the unyielding skull wall, and the fissures were narrowed or even obliterated because of the increased edema. Hemorrhages were frequent in the brain tissues, in the cerebrospinal fluid spaces, and in the retina.

Figures 16 and 17 (A 40-135), show the base of the brain of a woman, aged 32 years, who had suffered from malignant

of a boy, aged 13 years, with malignant hypertension. The massive cerebral hemorrhages are visible, one having ruptured into a lateral ventricle. There was a marked cerebral congestion and edema. Petechial hemorrhages were seen throughout the brain. The convolutions were flattened, and the sutures narrowed. There were a retinal edema and a papilledema with retinal hemorrhages.

#### SEQUELAE OF ARTERIOSCLEROSIS

*Hemorrhage.* One of the most frequent sequelae, manifestations, or complications of cardio-vasculo-renal affections of the retina and brain is hemorrhage. It may be petechial in size, as are those seen in the splinter or thornlike hemorrhages of endocarditis, in which the slight extravasation may be due to an impaired circulation, diseased vessel walls, or multiple emboli. Diabetic hemorrhages (fig. 5) are usually small and round, occurring in the deeper layers of the retina. Arteriosclerotic hemorrhages may present a similar appearance, or they may occur in the nerve-fiber layer as flame- or comet-shaped hemorrhages (fig. 10). Subhyaloid or vitreous hemorrhages may assume different shapes and may be of large size.

When the artery is obstructed, as a rule an ischemia is produced in the tissue it nourishes, although a hemorrhage may occur from an artery behind an embolus and break through into the surrounding tissues. Venous obstruction, on the other hand, with or without thrombosis, may result in rupture of the wall with marked hemorrhage.

Cerebral hemorrhages are usually arterial, and, depending upon their location and on the amount of bleeding, various symptoms occur. Cerebral hemorrhages generally arise from an arteriosclerotic vessel, a ruptured aneurysm, or an infected vessel behind an embolus.



Fig. 18 (Lyle). Cerebral hemorrhages and edema in malignant hypertension.

hypertension. The ophthalmoscopic examination revealed retinal arteriosclerosis with papilledema and retinal edema. The illness terminated in a fatal hemorrhage during which the head and eyes were turned to the left in a conjugate deviation, the lesion probably implicating the internal capsule on the left side. The pupils were dilated and fixed. The brain showed marked edema throughout, with flattened convolutions and narrowed fissures. There was some congestion of the smaller vessels, with arteriosclerosis of the larger ones.

Figure 18 (C 41-6) shows the brain

There are certain types of hemorrhagic encephalitides which will not be discussed here. The hemorrhages may involve the tissues of the brain, or may occupy the dural and arachnoidal spaces or the ventricles of the brain. They may be massive enough to produce increased intracranial pressure with papilledema (see charts 1 and 2).

Hemorrhage in the posterior frontal area, knee of the internal capsule, and peduncle may produce a conjugate deviation of the eyes. Hemorrhages in or about the brain stem may cause paralysis of one or of several of the external or internal eye muscles. Hemorrhages in the posterior temporal, lower parietal, or occipital lobes may produce visual-field changes which will be discussed further on.

Unlike the thrombus, which occurs when the blood pressure is lowered, and the embolus, which produces infarcts from cardiac or pulmonary infections, hemorrhage occurs with a rise in the blood pressure. It has a better prognosis than thrombus and embolus, as hemorrhages have a tendency to absorb, and, if no damage from their force or bulk has been done, symptoms may improve. Occasionally, the hemorrhages organize and behave as does a tumor.

Figure 19 (N 28-153) pictures a brain section of a woman, aged 50 years, who had cardiac hypertrophy and chronic vascular nephrosclerosis. The fundi showed advanced arteriosclerotic retinitis. A hemorrhage implicated the internal capsule, and produced a conjugate deviation of the eyes.

Figure 20 (A 38-84) shows a brain section with a blood clot in the left hemisphere involving the thalamus, knee, and posterior limb of the internal capsule. The basal and other arteries show numerous

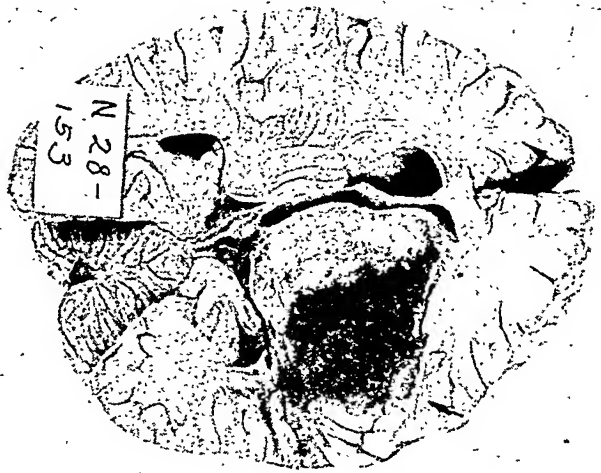


Fig. 19 (Lyle). Hemorrhage in internal capsule producing conjugate deviation of eyes.

atheromatous plaques. Examination of the patient revealed conjugate deviation of the head and eyes to the right. The right pupil was dilated, and both pupils reacted to light. A right facial weakness was present. The aberrant pyramidal fibers to the oculogyric and cephalogyric nuclei were involved within the knee of the internal capsule.

*Thrombosis* of the arteries of the brain and eye is relatively frequent. Thrombosis of the veins of the retina is about as frequent as is that of the arteries, but the veins, excepting the venous sinuses of the brain, are less likely to thrombose than are the arteries. Thrombosis increases with the age of the patient and the amount of arteriosclerosis present. It is the result



Fig. 20. (Lyle). Thalamic hemorrhage with conjugate deviation of eyes.



Fig. 21 (Lyle). Thrombosis of inferior temporal artery of left eye.

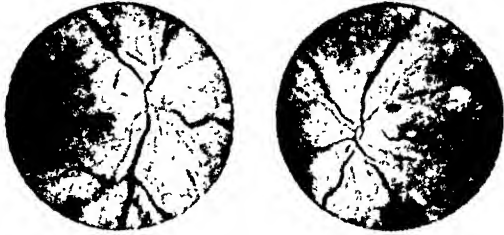


Fig. 22 (Lyle). Another case of thrombosis of inferior temporal artery of left eye.

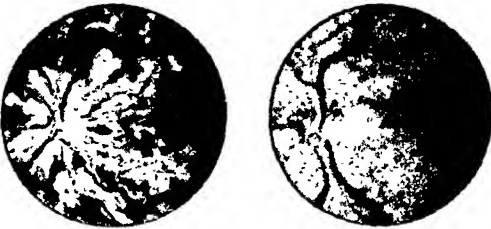


Fig. 23 (Lyle). Thrombosis of central retinal vein and the same fundus three months later.

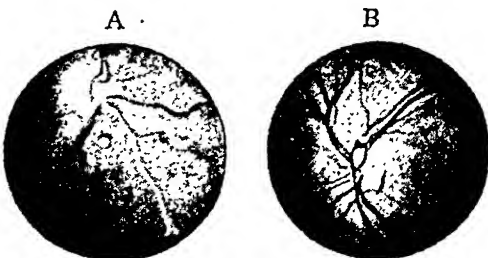


Fig. 24 (Lyle). A, Fibrotic or calcified vessel. B, Vascularization around a blockage at an arteriovenous crossing.

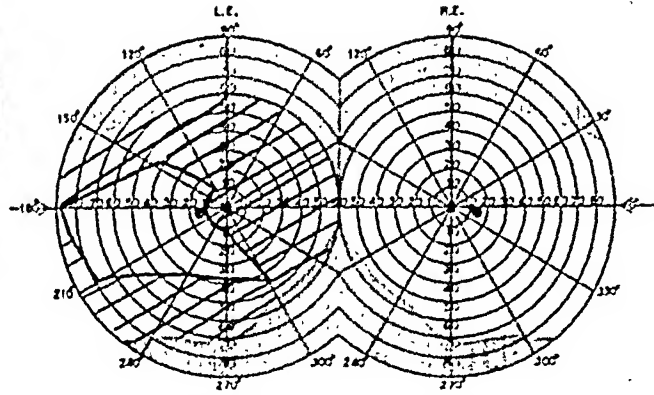


Fig. 21A (Lyle). Field defect from thrombosis of retinal artery.



Fig. 25 (Lyle). Thrombosis of left posterior cerebral artery.

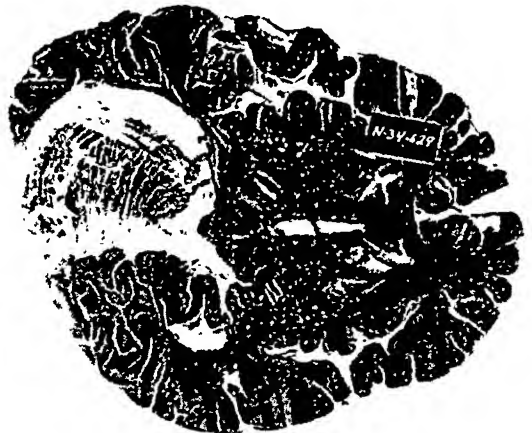


Fig. 26 (Lyle). Thrombosis of left posterior cerebral artery.

of diseased vessel walls, with a reduction of the lumen and a thickening of the intima. In addition, there are usually an increase in the coagulability of the blood and a slowing of the circulation. An embolus may slow the circulation, permitting the formation of a thrombus, or it may form after the reduction of the blood pressure following a hemorrhage. Even a slight rest that permits the reduction of blood pressure may be sufficient to cause the formation of a thrombus.

In the retina, a closing of the arterial lumen with a thrombus results in an ischemia, swelling and degeneration of that part nourished by the vessel, and the production of a loss in the visual field corresponding with this area.

Figure 21 shows a thrombus of the inferior temporal artery, with retinal degeneration and loss of vision (fig. 21A) in the area affected. Figure 22 is another case of thrombosis of a retinal artery.

Thrombosis of retinal veins occurs chiefly in the proximity of arterial crossings. From the arteries they derive a common vessel wall with all its tendencies to disease. Thrombosis of veins is evidenced by hemorrhages in the retina, usually at a point of constriction. These hemorrhages have a tendency to become absorbed, with restoration of some vision at least.

Figure 23 shows a thrombosis of the retinal vein, and the same case about three months later. Much of the vision has been restored. The absorption of the hemorrhage and the return of vision may be aided by a collateral or repaired circulation, which is occasionally seen even before the hemorrhage occurs.

Figure 24 shows the formation of new vessels behind an arteriovenous crossing where the vein is becoming compressed.

Thrombosis of cerebral arteries is found relatively frequently in arteriosclerotic patients who have superimposed

toxemias and infections. It forms in those individuals exhibiting a lowering of the blood pressure, whereas hemorrhages are frequently the result of increased blood pressure.

Thrombosis of the ophthalmic or the central artery of the retina may lead to sudden blindness. After a week or two of recurrent dimness of vision the patient may awake one morning and find himself blind, not infrequently in both eyes. I recall seeing a patient who developed complete blindness during sleep. He was a man, aged 65 years, with generalized arteriosclerosis and a low blood pressure. His fundi were pale. Some blood in broken columns was still passing through the retinal vessels, slowing to a stop, and then moving on. The vessels were markedly sclerotic. There were no retinal hemorrhages nor exudates.

Thromboses of the middle cerebral artery may show homonymous visual-field changes, and, if they are on the left side in right-handed persons, they may produce various types of aphasia or apraxia. Thrombosis of the posterior cerebral artery involves the optic radiations and visual cortex producing homonymous field changes.

Figure 25 (A 34-82) is an illustration of the brain of a man, aged 73 years, with a blood pressure of 140/95, who had developed a thrombosis of the left posterior cerebral artery which supplies the posterior optic radiations and visual cortex. A right homonymous hemianopia was present. At postmortem examination a marked cerebral arteriosclerosis with narrowed convolutions, widened fissures, and compensatory hydrocephalus were found. There was a softening of the basal temporal and basal and medial occipital lobes.

Figure 26 (N 34-629) shows a section through the brain with a similar involvement of the left posterior cerebral artery in a woman, aged 62 years. On post-



mortem examination, almost complete destruction of the visual cortex and optic radiations was found. This case showed marked atheromatous changes in the basal vessels.

**Embolism.** Emboli are occasionally found in the retinal arteries, most frequently in the central artery within the papilla, where constriction and bifurcation of the vessels occur. The embolus,

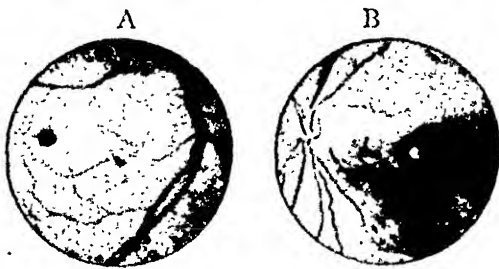


Fig. 27 (Lyle). A, Embolus in central retinal artery. B, Venous hemorrhage from blocking at papilla.

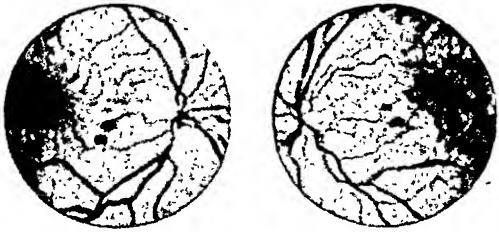


Fig. 28 (Lyle). Endocarditis with thorn-like hemorrhages in right retina.

by cutting off the blood supply to the retina, resulting in an ischemia, edema, and degeneration of the anterior layers of the retina, immediately produces blindness. Some vision may be retained if nourishment is provided by the cilioretinal vessels.

Figure 27 shows the retina of a young man who was suffering from an endocarditis and who suddenly became blind while at work. Shortly after the picture was taken the temperature rose to 105°F. The patient died several days later, death being due to the complications of septic emboli.

Occasionally, in endocarditis, minute

splinterlike or thornlike hemorrhages are seen in the retina. Some observers believe these are due to minute emboli in the arterioles and terminal vessels.

Figure 28 represents the retina of an advanced case of endocarditis with marked cyanosis, which is also visible in the fundi. In one central field these small, thornlike hemorrhages are seen. A central scotoma was present in this eye. Vision in the other eye was normal.

Cerebral emboli produce infarcts re-



Fig. 29 (Lyle). Emboli in branches of left middle cerebral artery.

sulting in symptoms depending upon the location. Figure 29 (N 33-158) shows emboli in the brain of a man, aged 30 years. Examination revealed an embolus of the left middle cerebral artery which produced a softening of part of the frontal, temporal, and parietal lobes, lenticular nucleus, and internal capsule. This involved many areas of interest to the ophthalmologist: the eye motor center in the posterior part of the middle frontal convolution, and the knee of the internal capsule through which the aberrant fibers pass to the eye motor nuclei. Involvement of these areas had resulted in the conjugate deviation of the eyes to the right. The higher psychic visual centers—the angular and supramarginal gyri—



were involved, as well as part of the optic radiations. This may have produced aphasias and apraxias of various types and homonymous visual-field changes.

An embolus in the posterior cerebral artery interrupting the optic radiations is seen in figure 30 (N 30-184). A man, aged 42 years, with cardiac hypertrophy, chronic myocarditis and endocarditis, and syphilitic aortitis had an embolus lodge in his left posterior cerebral artery which produced an infarct in the white matter of the temporal and occipital lobes affecting the optic radiations, resulting in a homonymous hemianopia.

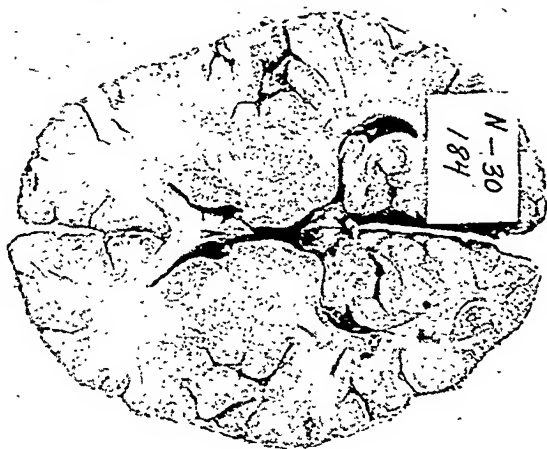


Fig. 30 (Lyle). Embolus in posterior cerebral artery implicating optic radiations.

aneurysm of the left internal carotid artery, with rupture into the subarachnoid space, displacing the left optic nerve. An

*Aneurysms* are found infrequently in the retina, but are relatively common in the brain. Retinal aneurysms are usually of the miliary or dissecting type, and usually occur in the smaller vessels, where there is a constriction, such as a vessel crossing. Retinal veins also show aneurysmal dilatations at vessel crossings in certain types of arteriosclerosis. Figure 27 B, shows a rupture of a vein at the disc margin. Prior to the rupture the vein was dilated as a result apparently of a blockage produced by a small cystlike object in the nerve head which is visible in the illustration.

Aneurysms in the carotid artery frequently implicate the optic nerve, chiasm, or tracts. Figure 31 is a retinal photograph of a bilateral optic atrophy in a woman in whom an aneurysm was found between the optic nerves at the chiasm, arising from the left internal carotid artery and extending up the left ophthalmic artery. The visual fields revealed a bitemporal hemianopia (fig. 31A).

Figure 32 (N 34-628) shows an

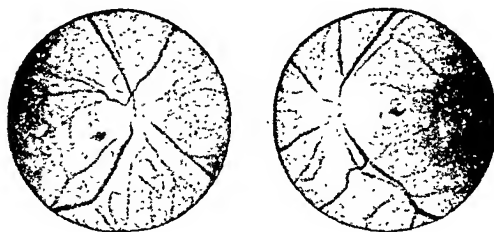


Fig. 31 (Lyle). Optic atrophy from aneurysm of internal carotid and ophthalmic arteries.

optic atrophy of the left eye had been present for years.

Figure 33 (N 34-422) is an illustration of an aneurysm of the basilar and the right vertebral arteries. Marked cerebral

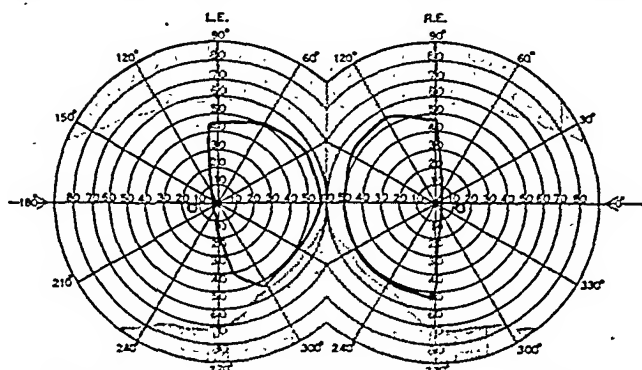


Fig. 31A (Lyle). Bitemporal hemianopia from aneurysm of carotid artery.

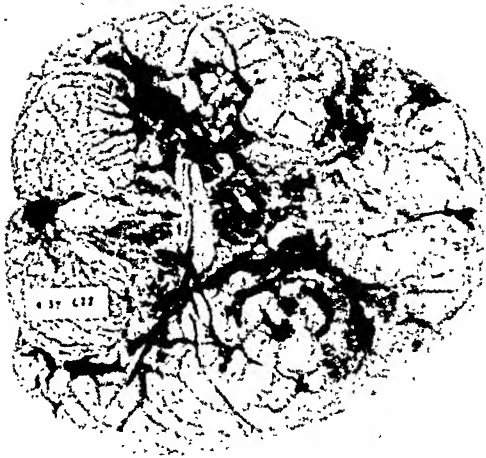


Fig. 32. (Lyle). Aneurysm of left internal carotid artery.

arteriosclerosis with atherosclerosis was found. The patient was a man, aged 82 years, who had paralysis of several cranial nerves, and had been blind for years owing to advanced arteriosclerotic retinitis.

*Vascular lesions producing visual-field defects.* Arteriosclerosis or hypertension in itself very infrequently produces a visual-field defect. However, when these lesions are combined with or augmented by toxic or metabolic affections so as to produce more

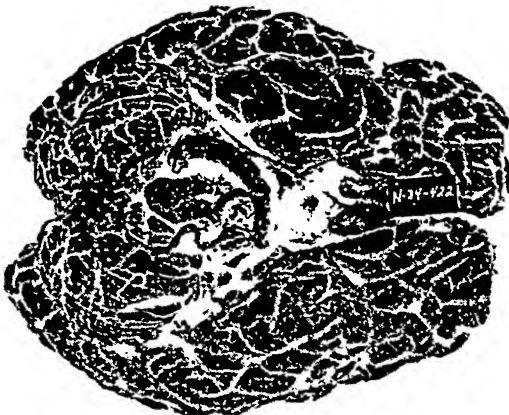


Fig. 33 (Lyle). Aneurysm of basilar and right vertebral arteries.

serious disturbance to the nourishment of the tissues, conditions arise which affect the visual fields.

In the retina hemorrhages, thromboses, and emboli impair vision, depending upon the nature, location, and extent of the vascular lesion. The visual-field defect corresponds to the area of the retina involved.

The optic nerve is seldom involved in vascular lesions, except secondarily, owing to a deficient blood supply. Chiasmatic arachnoiditis, meningovascular syphilis, and advanced arteriosclerosis may impair the nourishment to the optic

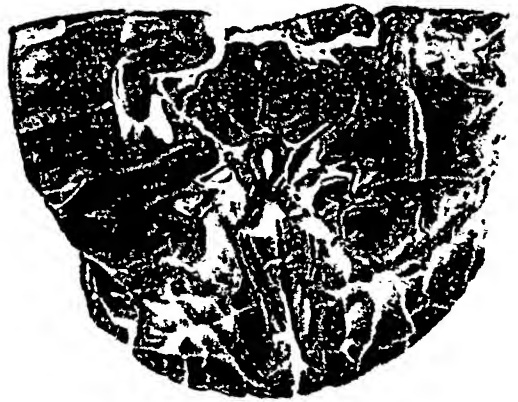


Fig. 34 (Lyle). Anatomic demonstration of chiasmal area.

nerve. Pressure from tumors such as aneurysms (fig. 31) and pituitary neoplasms, is not infrequently the cause of field defects from optic-nerve implication.

Marked arteriosclerosis of the base of the brain, by affecting the intracranial portion of the optic nerves, chiasm, or tracts, produces field changes. Figure 34 (N 39-38) demonstrates the relationship between the internal carotid artery and the chiasmal area. From this it is not difficult to visualize binasal, altitudinal, or bizarre field changes.

Figure 35 represents the retina of an advanced arteriosclerotic. The illustrations show a cavernous atrophy of the disc—so-called "pseudoglaucoma." The visual fields indicate binasal hemianopia.

Figure 36 shows an altitudinal and nasal defect produced by the pressure of sclerotic arteries on different parts of the optic nerve, chiasm, or tract. The fundus reveals some pallor of the papilla, with the senile type of arteriosclerosis. X-ray study showed some

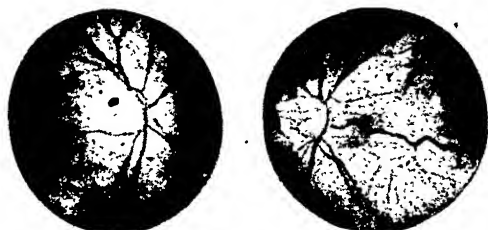


Fig. 35 (Lyle). Cavernous atrophy of optic discs or pseudoglaucoma.

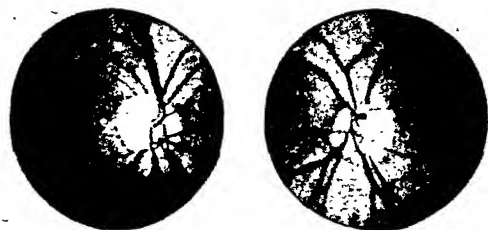


Fig. 36 (Lyle). Optic atrophy from carotid sclerosis.

shadow of the knee of the carotid arteries.

The optic tract is rarely implicated in vascular lesions, except as the result of blood clots and aneurysms. Near the chiasm bitemporal defects may appear in the visual fields. More frequently there are homonymous sector or quadrant defects, incongruous in relationship one to the other, with sloping edges. In tract lesions the central vision (macular bundle) is more frequently involved than is the case when the optic radiations and cortex are affected. However, visual fields in themselves do not definitely establish the site of lesions in homonymous field

defects. This may be in tract, radiation, or cortex. Wernicke's phenomenon is uncertain and difficult to obtain.

As the radiations fan out from the lateral geniculate body through the posterior temporal and occipital lobes and lower border of the parietal lobe to the visual cortex, visual-field defects may vary greatly in size and shape. In these

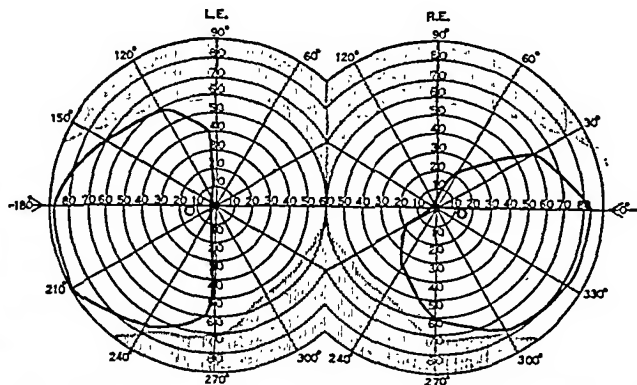


Fig. 35A (Lyle). Binasal field defects with cavernous atrophy of discs.

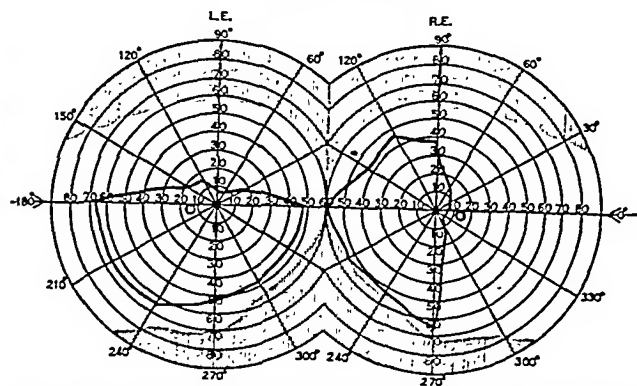


Fig. 36A (Lyle). Altitudinal and temporal defect from cerebral arteriosclerosis.

cases the field defects are usually congruous throughout their development or recession. The central fixating area is generally spared, probably because of a dual blood supply, although some believe that the macular representation is quite extensive in the visual cortex. In the brain substance, as in the retina, the vascular lesions that produce the visual-field changes are usually hemorrhage, thrombus, and embolism.

A woman, aged 58 years, has, as is shown in the illustration (fig. 37), a ret-

inal arteriosclerosis. Her blood pressure is within normal limits. Her visual fields show a homonymous lower-quadrant defect which apparently is due to a softening, the result of a thrombosis of the upper optic radiations or visual cortex on the left side. As some sensory aphasia is present with visual and auditory disturbances, the lesion is fairly well localized in the region of the angular gyrus and ad-

news in the press. It was not uncommon for him to collapse and to be carried out with a hemorrhage from which he would recuperate and return to the battle. Occasionally he would not run for mayor and would rest. At these times, his blood pressure would become much lower with the tendency to thrombosis. When first seen, the blood pressure was normal, the visual fields showed a homonymous



Fig. 37 (Lyle). Progressive retinal vascular changes with cerebral thrombosis.

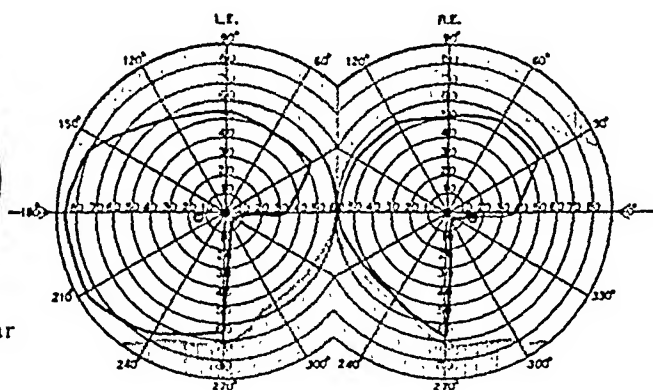


Fig. 37A (Lyle). Lower homonymous quadrant defect.

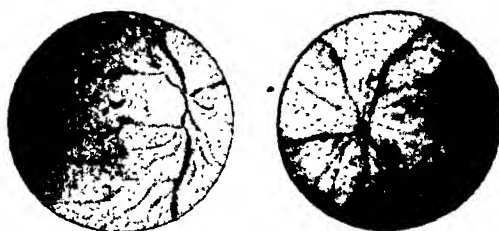


Fig. 38 (Lyle). Retinal sclerotic changes in right and left eye.

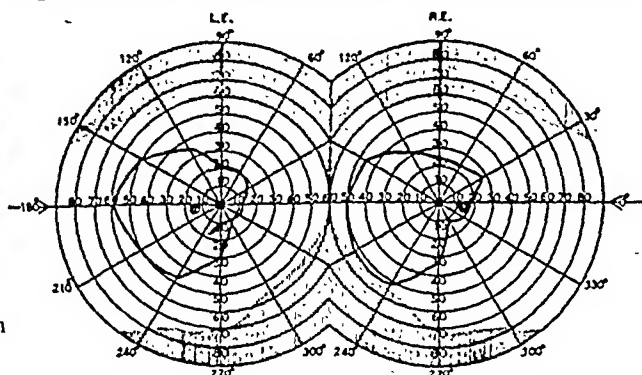


Fig. 38A (Lyle). Homonymous hemianopia from cerebral arteriosclerosis.

jacent superior posterior temporal convolution.

Figure 38 shows a more marked vascular condition in which the symptoms from hemorrhage when the blood pressure is raised, and from thrombosis when the pressure is lowered, are seen. This case was an interesting one. The patient was the mayor of a neighboring town and was a great reformer. Because of his daily court sessions, his physicians could follow his case as he made front-page

hemianopia (fig. 38A). The fundi showed a marked arteriosclerosis. Later the blood pressure increased and the fundus of the left eye became edematous with the appearance of hemorrhages. Finally, after several more episodes, the headlines in the press read, "Mayor ——— stricken by brain hemorrhage, collapses in court." He did not survive this attack.

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# A MODIFICATION OF THE CORNEAL SECTION IN THE OPERATION FOR CATARACT\*

AN AB EXTERNO APPROACH

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The ideal section, be it corneal or scleral, for the removal of cataract is one in which the superficial and deep margins of the operative wound are parallel and coextensive. This obviously can be achieved only when the completed incision is perpendicular to the plane of the globe. As usually performed with the cataract knife or keratome, the section is, of necessity, beveled, since the instrument enters and leaves the anterior chamber at an acute angle. As a result of this beveling or shelving, the inner lip of the wound, and hence the entrance into the anterior chamber is somewhat shorter than the external incision. A successful cataract extraction depends, in no small measure, upon a correct corneal section. A poorly executed section not only impedes the operation but may even eventuate in disaster. It is very important that the exit for the passage of the cataract be adequate for its easy transit.

The author has devised a simple technique that meets the stated requirements of the ideal section. This technique is not mentioned in any of the available textbooks, nor has a rather hasty survey of the literature revealed any allusion to it.

The writer proceeds as follows:

The operative field is prepared in any of the accepted ways, preference being given to carefully dabbing the lid margins with tincture of iodine. The orbicularis oculi is paralyzed by injecting 2-percent solution of novocaine in the facial nerve in front of the tragus. Surface anesthesia is accomplished with the use of cocaine.

Retrobulbar anesthesia, a solution of novocaine and adrenalin, is resorted to only when the surgeon apprehends lack of coöperation on the part of the patient or when increased intraocular pressure is present. The eyeball is depressed with a bridle suture through the belly of the superior rectus muscle; this also helps to steady the eyeball. The ends of the suture are held by a mosquito artery clamp, or, better still, by the fingers of the assistant who can thus regulate the tension of the suture, and so control the degree of the depression of the eyeball and avert undue separation of the lips of the operative wound.

The incision, approximately a semi-circle in the upper periphery of the cornea, is divided into three parts, each subdivision being demarcated by dots made with a sharp-pointed toothpick dipped in alcohol gentian-violet solution. The first dot is 1 mm. above the lateral extremity of the horizontal meridian of the cornea and slightly in front of the corneoscleral junction. (The corneoscleral junction is the posterior boundary of the limbus. The limbus is widest superiorly and narrowest at the sides. Not infrequently, the limbus is unduly wide above. One must not confuse an arcus senilis, which is often prominent in these cases, with the continuation of the limbus. There is always a narrow transparent ring between the anterior limit of the limbus and the peripheral margin of the arcus senilis.) The second dot is similarly placed in relation to the medial extremity of the horizontal corneal meridian. Two dots are painted on the cornea above, circumscribing a

\* Read before the New York Society for Clinical Ophthalmology on January 3, 1944.

3-mm. interval, each dot being equidistant from the respective extremity of the horizontal meridian (fig. 1). An attempt should be made to render the operative field bloodless to avoid blood seeping into the anterior chamber. This may be effected by instilling a few drops of adrenalin and making the incision wholly in the cornea somewhat behind the anterior border of the limbus. The surgeon need not fear that the opening into the

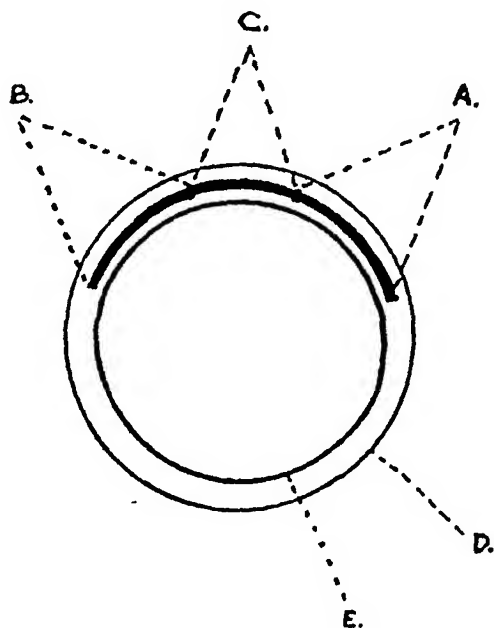


Fig. 1 (Bailey). Semi-diagrammatic.  
 A. First subdivision of section.  
 B. Second subdivision of section.  
 C. Third subdivision of section.  
 D. Posterior border of limbus.  
 E. Anterior border of limbus.

anterior chamber will be inadequate for since the incision is perpendicular to the cornea, there is no need to make a very large flap when performing either an intracapsular or extracapsular extraction.

With conjunctival forceps a deep bite is taken into the conjunctiva a few millimeters behind the limbus, and by drawing the grasped tissue back and thus putting it on the stretch, the conjunctiva is prevented from overlapping the limbus and obscuring the path of the incision.

Orientated by the stained dot at the extremity of the proposed section, the surgeon penetrates the cornea with the point of the knife. This he does lightly and slowly so as to avoid a sudden escape of the aqueous with the accompanying prolapse of the iris. It is desirable that the handle of the knife be held at an acute angle of about 45 degrees; otherwise, the back of its tip will also engage the cornea and penetration will be impeded. The incision should be wholly in the cornea since the sclera offers much greater resistance to the cutting instrument. Should the iris prolapse, it is easily replaced. The penetration of the cornea is continued until the ipsilateral upper dot is reached. The operator now sweeps a spatula between the lips of the wound to ascertain whether there be any uncut strands of tissue in the depth of the wound; if so, these are divided with a snip of the scissors. For this purpose the writer uses a very fine blunt-pointed curved scissors: in lieu of these, one may employ a curved iris scissors. Preliminary sutures, with loop sufficiently wide, so as not to impede the exit of the lens, are inserted into the lips of the incision. The opposite side of the cornea is now treated in like manner. There still remains the upper 3-mm. bridge of cornea: this is severed with a single cut of the scissors, and a suture into the anterior lip is so placed that it can be used later to reflect down the corneal flap as described by Kirby. If the surgeon contemplates an iridectomy, it can be done satisfactorily at this time, for, by raising the corneal flap the iris is exposed directly and fully, from pupillary margin to periphery, riding on the lens, and can be grasped at any optional point with great ease. At no time is dangerous pressure exerted upon the eyeball, for in all cases in which this method was used, there was no single instance of loss of vitreous prior to the completion of the



section and the introduction of the sutures.

As one proceeds with the operation, the eyeball becomes soft and the iris is in contact with the posterior surface of the cornea, owing to the unavoidable escape of the aqueous fluid. Should this offer any difficulty to the surgeon he may resort to the following alternative procedure: A deep groove is made with the knife along the line of the planned incision; at one end of the groove the cornea is perforated, and the subdivision of the incision is then completed as previously described with scissors instead of with the knife.

The remaining steps of the cataract extraction are those of the Verhoeff-Kirby technique. The writer, however, prefers to rupture the suspensory ligament with an ordinary lens spoon instead of with a muscle hook. The former has certain advantages. Being a one-directional instrument the operator can steady it more firmly, and thus measure more accurately the pressure he exerts upon the globe. Furthermore, because such an instrument can be maneuvered more easily, it is less likely to slip too far forward upon the cornea, or too far back over the ciliary body. The spoon is very thin and can be readily insinuated in the circumferential space between the apices of the ciliary processes and the equator of the lens so that the pressure can be exerted directly upon the fibers of the suspensory ligament and perpendicular to them, an obvious mechanical advantage; although Goldsmith (Transactions of the Section on Ophthalmology, American Medical Association, 1942) states that he has proved experimentally that the pressure is most effective when applied 2 mm. behind the limbus.

In suturing the corneal flap, it is important that the lips of the wound be firmly held in the grasp of a thin but sturdy mouse-tooth forceps; otherwise,

they will slip out of the forceps during the passage of the needle. It is equally important that the needle take a deep bite so that it will not tear through the edges of the wound. In its progress through the tissue, the needle should describe an arc corresponding to its curvature. The needle should be very fine, consistent with strength; it must be well tempered to prevent bending; it should be short, full curved, keen pointed, and of the atraumatic type. I use a short suture, about 6 inches long. The ends of a short suture are more easily grasped and tied by the forceps, and are less likely to become entangled. One must not fail to take up the slack in the temporary loop before making the final knot of the suture.

Davis & Geck of Brooklyn, New York, have supplied me with a suitable atraumatic needle and suture. I quote their description: "The special sutures, C 301, consist of Anacap black braided silk rendered non-capillary by a special process. They are size, Six-0, length 18 inches, double-armed, with the finest size atraumatic needles. The needles are of polished carbon steel, with a special triangular point which is an improvement on the ordinary triangular point used on surgical needles."

The knife selected for the operation consists of a small handle (Bard-Parker handle, no. 6) and a curved blade that fits into the slot of the handle. The writer uses a blade made by the American Safety Razor Corporation of Brooklyn, New York. This blade (No. 12) is sharper and smaller than Bard-Parker's (see fig. 2). The blade is sufficiently keen, is removable, and inexpensive, costing about 12 cents. It may be discarded after each operation, but a thrifty surgeon can use it several times satisfactorily. I have employed this knife in many other operations on the eye; for example for operations on the lacrimal sac and wherever a small



knife is applicable. In my hands, it has supplanted the keratome for opening the anterior chamber in the following cases: iridectomy for glaucoma, optical iridectomy, and dissection of cataract with scissors. There is no shelving of the operative wound, the anterior chamber is

(4) This section is feasible in the presence of a shallow anterior chamber or even when the chamber is completely obliterated. (5) The ample opening into the anterior chamber precludes the necessity of an extensive corneal section when performing the intracapsular type of ex-

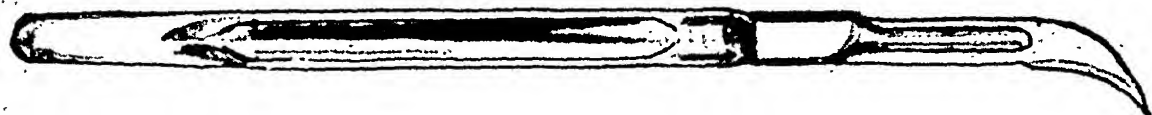


Fig. 2 (Bailey).

entered peripherally, and the manipulation of instruments in the chamber is facilitated.

The author believes that the operation described herein presents the following advantages:

(1) Immobilization of the eyeball is not necessary, hence, the surgeon may dispense with the use of fixation forceps. Not infrequently fixation of the eyeball is unsatisfactory; especially if the conjunctiva is friable and a deep grasp of the episclera, for various reasons, is not obtained; or when the patient persists in moving or rolling the eyeball. Furthermore, when in an early stage of the cataract extraction, vitreous loss occurs or is impending and pressure upon the eyeball is meticulously to be avoided, the presence and action of the fixation forceps aggravate the situation. (2) The section is made in a single plane. With the cataract knife, the section is usually consummated in several planes and hence is irregular, for two or more strokes of the knife are required, and furthermore there is a tendency to a sawing motion. (3) The surgeon can control the size and position of the corneal section. As ordinarily performed, the corneal flap often deviates from the one planned or desired.

traction or when dealing with a large sclerosed lens. (6) There is no opportunity for the iris to fall upon the edge of the knife, as may happen when the section is made with a cataract knife. (7) The large opening in the periphery of the anterior chamber (thanks to the perpendicular direction of the knife) allows the surgeon to envisage the equatorial region of the cataract and permits its easy grasping by the forceps, especially when the corneal flap is reflected down as in performing the intracapsular extraction according to the method of Verhoeff as modified by Kirby. Likewise, a facile iridectomy can be performed, since the iris is in full view. (8) The location of the incision avoids the possibility of injury to the ciliary body, which may occur occasionally when the surgeon, while making the puncture or counterpuncture with the cataract knife, directs the point of the knife too far back, owing to the behavior of the patient or for some other patent reason. Nor does the surgeon have to watch the position of the point of the cataract knife when making the counterpuncture, as in the ordinary type of section. (9) There is less danger of vitreous prolapse since the section is divided into three parts and each subdivision is com-

pleted before proceeding with the next one. (10) The surgeon may choose his right or left hand when operating on either eye. Ambidexterity offers no advantage. (11) The knife is held easily and firmly against the eyeball throughout the operation: hence, the surgeon need not steady his hand upon the patient's face, as is done in the usual section with the cataract knife or keratome. (12) The operative wound is sutured with less difficulty and with greater security. Since the lips of the wound do not slant they are grasped with the forceps with less tendency to slipping and the needle takes a stronger bite without lacerating or tearing through the tissues. The lips of the wound are regular and readily brought into apposition, thus favoring healing and minimizing postoperative astigmatism. (13) Although the knife has a sharp point and edge, it need not possess the exquisite keenness demanded of a cataract knife. (However, if for any reason the surgeon is not satisfied with the particular blade selected, he may use, instead, a Wheeler discission knife or a fine-pointed cataract knife.) (14) This technique has been

employed with satisfaction in cases of ordinary senile cataract, subluxatio cataractae, cataract in high myopia, cataracta complicata, and in cases of cataract associated with glaucoma in eyes that had previously been subjected to iridectomy or iridosclerectomy. (15) An important adjunct to a successful cataract extraction is confidence on the part of the surgeon as he proceeds in the successive steps of the operation. The technique described herein effects a correct corneal section, proper insertion of the sutures, and full exposure of the iris and cataract, factors that put the surgeon, en rapport, so to speak, with the case.

#### SUMMARY

An operation for cataract is described in which the corneal flap is fashioned by an incision from without inward and perpendicular to the plane of the globe. The advantages of the procedure are enumerated and explained. The instrument employed is a short Bard-Parker handle and an attached blade which is keen, inexpensive, and replaceable.

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## A NEW GONIOTOMY LENS

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From the time the first lens was introduced for gonioscopy or goniotomy to this date no significant change in its design had been made.<sup>1</sup> After using the standard lens for goniotomy, this writer decided that the method was not at all practical, and either must be radically changed or discarded. Incision in the

the anterior chamber angle was filled with tissue. This persisted in lower animals, as the pectinate ligament. In the normal human eye this was not present, but in eyes in which this tissue did not disappear the corneoscleral trabeculum was covered over and blocked. With the gonioscopic lens the corneoscleral trabeculum and

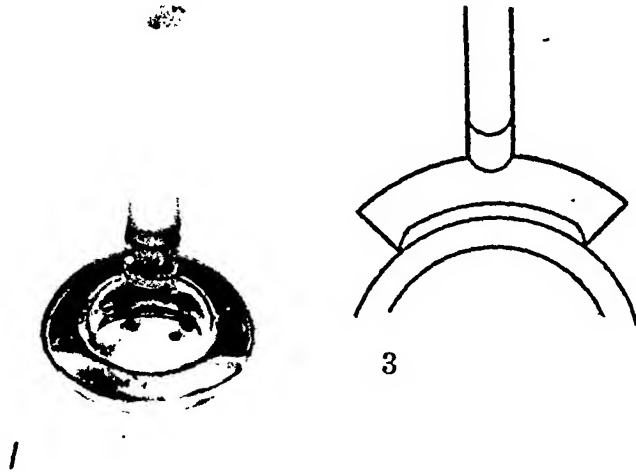


Fig. 1 (Ellis). Plastic gonioscopy lens. Fig. 3, diagrammatic cross section of new lens resting on the cornea.

chamber angle without direct observation had been performed, but this seemed to the writer to be too dangerous and uncertain of results. Dr. Otto Barkan<sup>1, 2, 3</sup> of San Francisco has contributed greatly to the knowledge of the anterior chamber angle, and highest tribute must be paid to him for his meticulous and exhaustive work, and his reintroduction and modification of the technique of goniotomy. He was especially interested in congenital glaucoma which, in brief, he explained in the following manner: In the early stages of the development of the eye

even the internal annular ring were obscured. It was readily understandable that this tissue would interfere with aqueous drainage.

In his first experimental work the writer, remembering the first ophthalmoscope and using a glass slide with a drop of water on the cornea, repeated the procedure on enucleated rabbit eyes. The chamber angle could be clearly seen, and that the incision was made into Schlemm's canal was proved by microscopic section. The enucleated eyes were small, soft, and pliable; thus a large area of the cornea could be flattened. Owing to the more rigid structure of the human eye, this

\* Now in the Armed Forces.

procedure could not be used on the living person.

With a regulation plastic gonioscopy lens (fig. 1) in place, the top surface area needed for observing one quarter to one third of the human chamber angle was outlined with a glass-marking pencil. This area was egg-shaped and measured about 15 by 18 mm (fig. 2a). By leaving the top surface this size (with the handle near the small end), and grinding the

of this inner surface was made and covered with nail polish so that the power could be read directly with the keratometer. This reading was 27D. The corneal curvature of an enucleated rabbit eye was measured and found to read about 30D. This was the answer to why the lens gave excellent experimental performance, but did not work well on the human eye.

A plaster mold was made of the un-

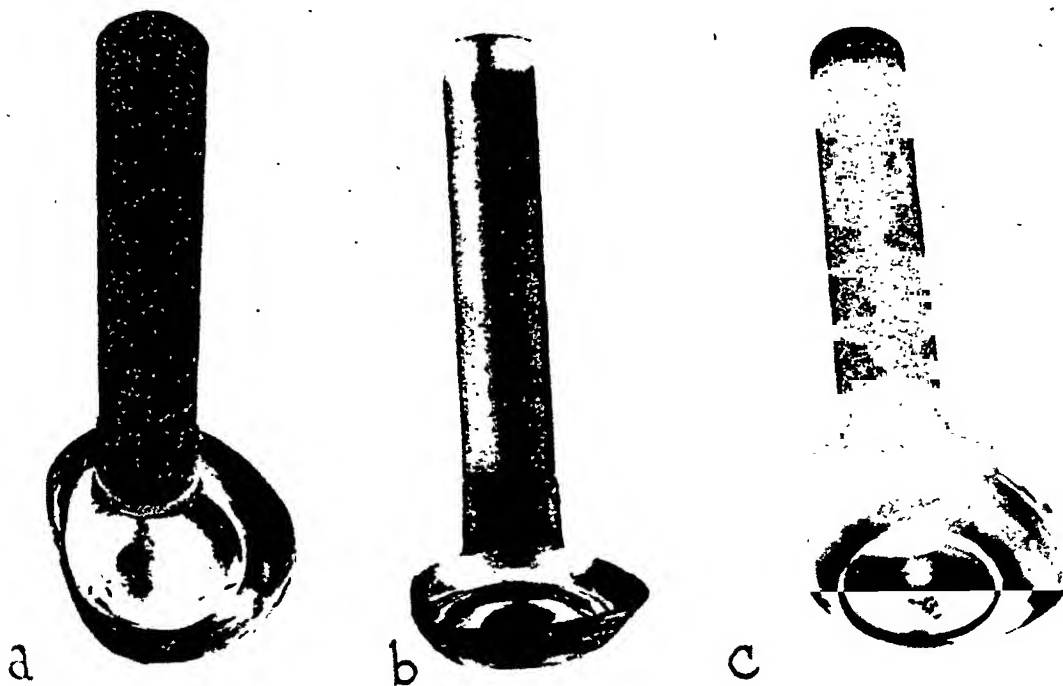


Fig. 2 (Ellis). a, top surface of new goniotomy lens; b, side view of new goniotomy lens; c, bottom surface of new goniotomy lens.

edges angled sharply in (fig. 2b), most of the central area of the concave or inner surface remained (fig. 2c).

Next the inner curvature was reground to  $-40D$ . For the excised rabbit eyes this was found to be a definite improvement, and was used in the operation on the left eye in case 2. Saline was used between the lens and the cornea for the operation. Considerable corneal striation was present which somewhat obscured vision. It was obvious that the inside curvature was too flat, and a wax mold

changed inner surface of a plastic goniotomy lens. The central curvature measured  $-75.62D$ , and near the edge (not the outer lip) the curvature varied from  $-76$  to  $-92D$ . Again by using the wax-mold technique, the central area was found to have a keratometer reading of  $42D$ .

The top surface of a second plastic gonioscopy lens was cut down and the edges were angled in as previously described. The inner curvature was left unchanged, and measured 9 mm. in di-

ameter. The sharp edges were smoothed and all surfaces polished. Another advantage was now apparent. Owing to the fact that the curvature of the inner surface of the lens increased near the edge, the outer rim of the new lens would be the portion resting heaviest on the cornea (fig. 3), so that abrasions would occur chiefly near the periphery, and least at

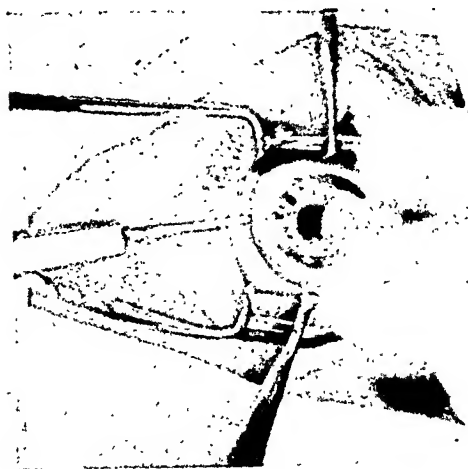


Fig. 4 (Ellis). Goniotomy with the new lens. The knife is entering the cornea.

the center of the cornea where clear visibility was imperative.

During this experimental work it was found that often, after the anterior chamber was deepened by injecting saline, even though the knife entered the cornea at an oblique angle, the fluid would leak out and the anterior chamber would again become shallow. Special needles with a stop half way up the shaft of a one-half inch, #27-gage hypodermic needle were devised. With this needle on a 2-c.c. syringe filled with equal parts of saline and water, an assistant could readily keep the tip of the needle in the anterior chamber, maintaining it at a proper depth.

In the preoperative care and immediately before surgery prostigmine was used, as this had been found to be the most effective miotic in buphthalmos and juvenile glaucoma.

For illumination two Shahan lamps were used at the level of the patient's eye angled in at 45 degrees with their light beams superimposed on the field. The surgeon's eyes should be nearly at the same level as the patient's eye. Adequate magnification was secured with a Zeiss telescopic loupe.

General anesthesia was used in all cases, ether for the infant and intravenous sodium pentothal for the two juvenile-glaucoma patients. To avoid corneal damage no local surface anesthesia was given. Novocaine was injected subconjunctivally, superiorly and inferiorly, at the areas of fixation in the two juvenile-glaucoma cases. The anesthetist was informed when the surgeon was ready to enter the eye, so that the anesthetic could be deepened for the duration of the incision.

In the operation, a lid speculum was put in place; then the assistant grasped the conjunctiva firmly at the limbus with two broad conjunctival forceps at the 6- and the 12-o'clock position. The eye was flooded with saline, and the new lens was placed directly on the cornea. The operator held the lens in the left hand, and adjusted it so that the chamber angle was clearly seen. Since the lens angled sharply from the cornea, ample room remained for the introduction of the goniotomy knife (fig. 4).

The knife entered the cornea just above the corneoscleral junction at the temporal horizontal meridian. It was important that the cutting side of the blade should face to the left. The knife entered the anterior chamber, crossed the center, and entered the chamber angle still on the horizontal meridian. The angle was now incised with a counterclockwise sweep to the left. For the right eye the incision was from the 3- to the 12-o'clock position, and for the left eye from the 9- to the 6-o'clock position. In each instance a small amount of blood came from the area of incision in

the chamber angle. About one quarter of the length of Schlemm's canal can be incised in this manner. In these reported cases, incision was made into the pectinate ligament, since this tissue obscured view of the corneoscleral trabeculum.

Postoperatively eserine ointment and eye pads were applied to each eye and the patient was placed on the side with the eye that had been subjected to surgery in the dependent position. In this manner the blood remained free of the operative wound.

For all the experimental work a Ziegler dissection knife was used, and even though in some instances the anterior-chamber fluid was mostly lost, at no time was damage to the lens or iris observed. In brief, it is the opinion of the writer that any small knife with a sharp point for ready entrance into the eye would be adequate.

The writer performed the goniotomy operation on three patients, whose records follow:

*Case 1.* Baby J. B., male, white, 10 months of age, was observed by the mother to have poor vision about six weeks previously. The latter stated that he had never grasped nor played with any objects (toys, rattles, and the like) as normal children usually do. He had made no attempt to sit up or move about. The birth had been spontaneous, without complications.

In the examination it could not be definitely determined that the baby had light perception. No attempt to grasp or follow a light was made. The child had the blank look of the blind. The corneas were clear and measured 13 to 14 mm. in diameter. The pupils were average in size (three to four millimeters) and reacted slowly to light. Under anesthesia the discs were seen to be pale, excavated, and the vessels were displaced nasally. The tension with Schiötz tonometer was 23 mm. Hg

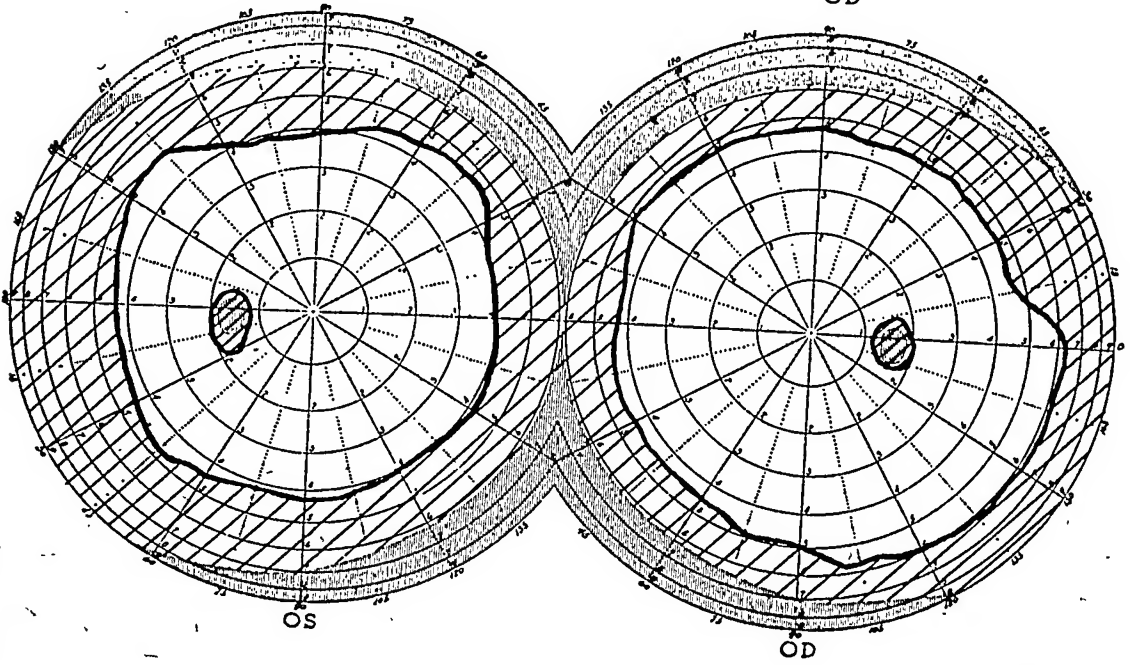
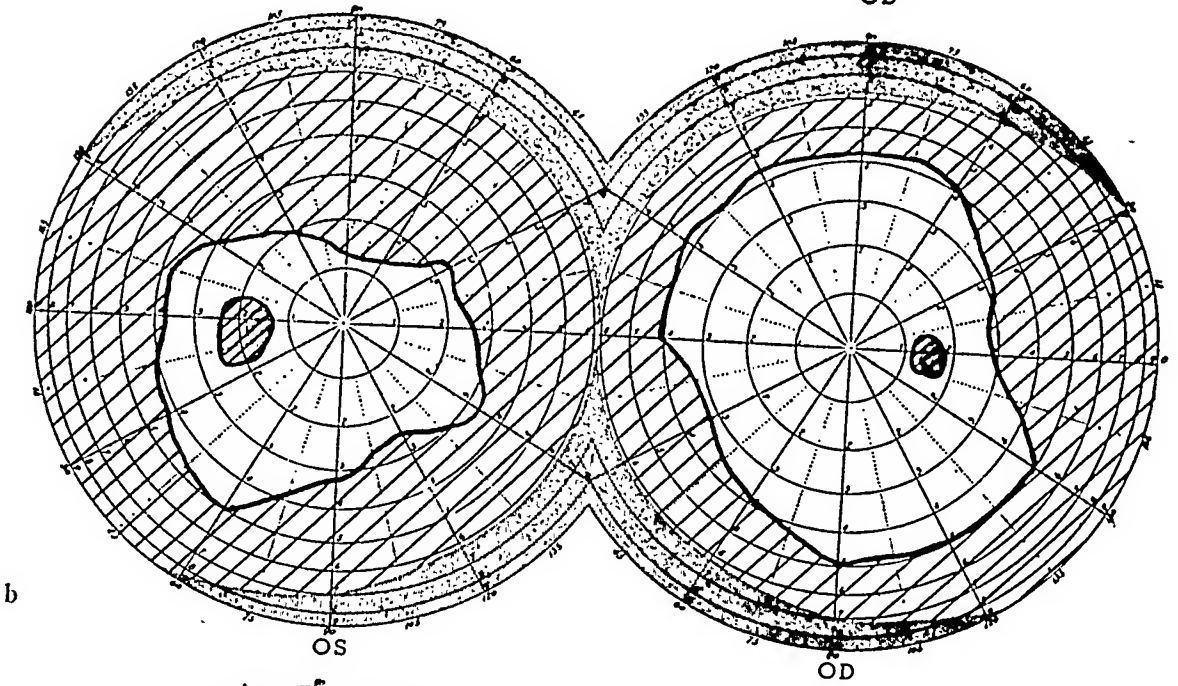
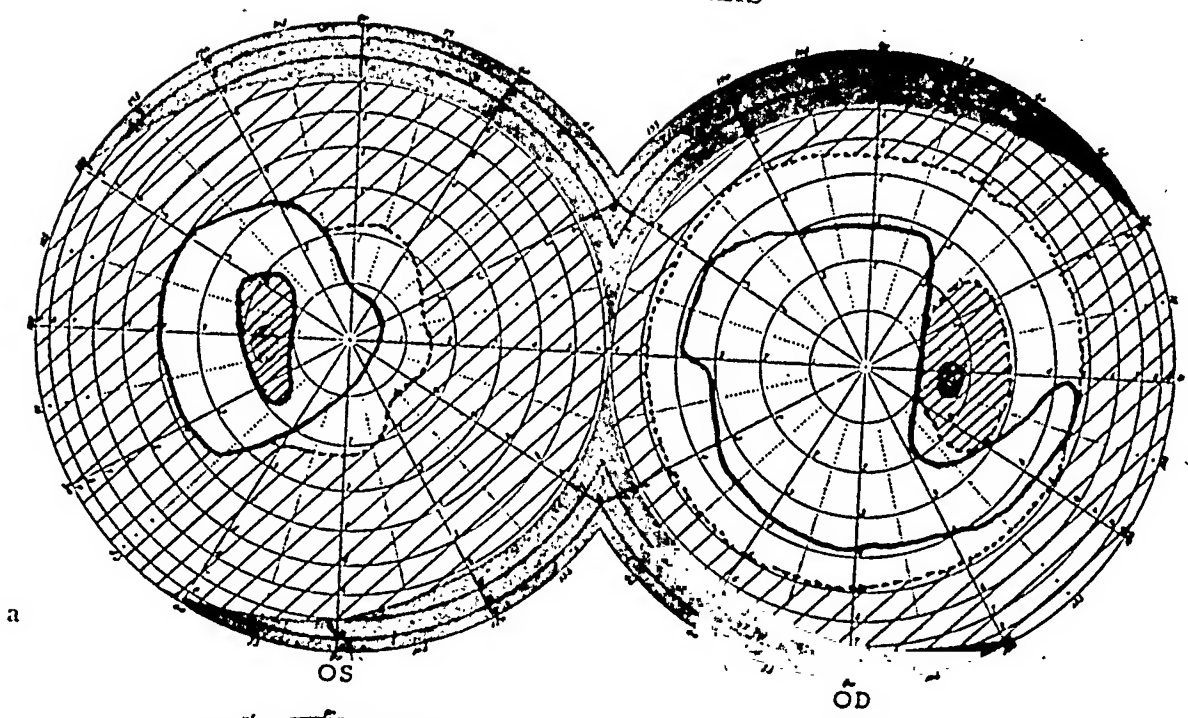
in each eye. Prostigmine, 5 percent, was prescribed to be used in the eyes, one drop every hour for four doses, then one drop every four hours.

A second ophthalmologist confirmed these findings on the following day. The baby was seen five days later, when light perception was definitely present, the eyes following the light. The pupils were small and well under prostigmine. Tension in the right eye under ether anesthesia was 28 mm. Hg, and in the left eye, 24 mm. Gonioscopy was performed, and the chamber angle at all points in both eyes was seen to be blocked with tissue, as had been anticipated.

On February 17, 1943, a goniotomy was performed with the glass operating lens, the Barkan technique<sup>4</sup> being employed, and an incision was made into the chamber angle of each eye. Following each procedure a small amount of blood came into the anterior chamber from the area of the incision.

The postoperative course was complicated by an upper respiratory infection, but was otherwise uneventful. Prostigmine drops were used in each eye for four months. The tension was taken at short intervals for five months postoperatively, and the readings were 17 mm. Hg or less in both eyes. Three months after surgery the mother proudly stated that the patient was starting to walk and was rapidly catching up to his normal stage of development. The child's eyes were bright and, except for the increased corneal diameter, appeared normal.

*Case 2.* Mrs. C. M. M., female, white, aged 22 years, was seen through the courtesy of Dr. L. Bramwell on May 7, 1943. She stated that headaches had begun six years ago, with occasional attacks of blurred vision. Headaches had increased in intensity and frequency and had become severe in the past 1½ years; also for this time she had noted haloes around





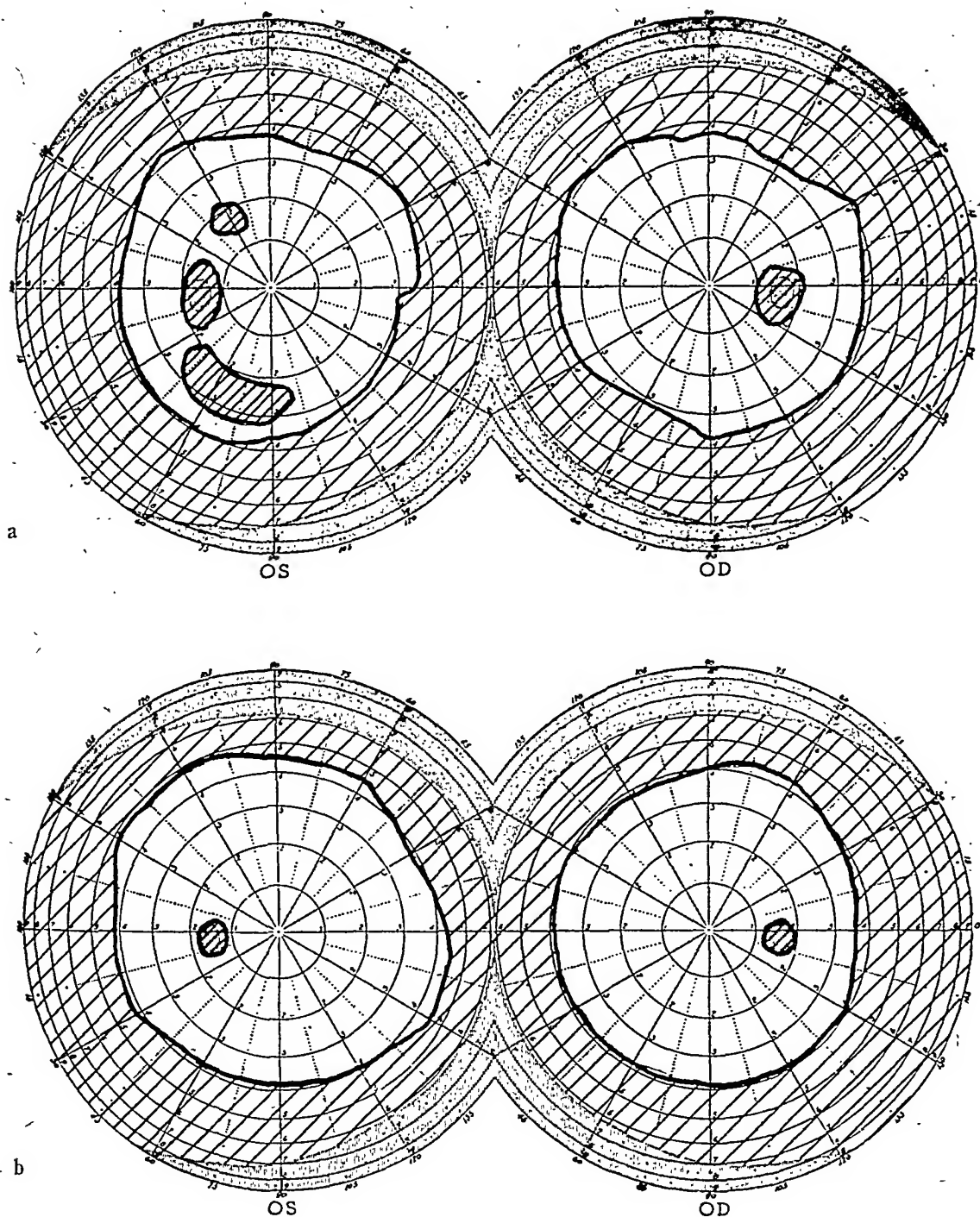


Fig. 6 (Ellis). Visual fields in case 3. a, fields as of June 25, 1943, preoperative, target 2/1,000; b, fields as of July 20, 1943, postoperative, target 2/1,000.

Fig. 5 (Ellis). Visual fields in case 2. a, fields as of May 7, 1943, preoperative. Solid line, 2/1,000 target; dotted line, 6/1,000 target. b, fields as of May 24, 1943, postoperative. c, visual fields as of June 7, 1943; both postoperative fields taken with 2/1,000 target.

lights. Two-percent pilocarpine had been used for the past two years, but for the last eight weeks was no longer effective. Prostigmine had been prescribed, but was soon discontinued because it induced extreme discomfort. The patient's general physical condition was reported to be without significant findings. Dr. Bramwell reported that the tension had been 30 mm. Hg in each eye on three different visits to his office over a period of six months.

In the examination the vision of the right eye was 20/40 not improved with glasses. Vision of the left eye was the ability to count fingers at two feet, which was improved to 20/50 with glasses. The eyes were externally normal in appearance. Fundus examination showed discs of a good pink color, with small physiologic cups. The blood vessels were not displaced. Visual fields were recorded as shown in figure 5a. Slitlamp examination was without significant findings. Examination with the gonioscope lens showed the anterior-chamber angle to be entirely filled with tissue. The internal annular ring could not be seen. Tension in each eye was 13 mm. Hg. On May 12, 1943, goniotomy was performed on the left eye with the first lens described. It was found to be a vast improvement over the Barkan technique, but due to the corneal striations, induced by the flat curvature, was not perfect. Three days later the operation was done on the right eye, and the second lens was used. The ease with which the procedure was carried out with a large portion of the blocked angle clearly in view contrasted markedly to the difficulties encountered when the original glass operating lens was used.

Two days later the tension in each eye was 9 mm. Hg. Nine days after the second eye was operated upon the vision had improved, and both fields showed a large increase in size. Prostigmine drops post-operatively did not cause the cramping

experienced before surgery, and were used regularly in each eye. Later it was suspected that the intraocular pressure was rising occasionally, and a 24-hour tension curve was taken. Following the use of either pilocarpine or prostigmine the intraocular pressure was found to rise. All medication was discontinued, and the tension taken at numerous occasions since then had been 13 mm. Hg. Visual fields taken after surgery are reproduced in figures 5b and c.

*Case 3.* H. G., male, white, 15 years old, complained of headaches beginning at 6½ years of age. Vision had been occasionally blurred, and he had been unable to read with comfort for the past three years. Headaches were frequent, usually daily, and he had noted that with severe headaches his vision was definitely blurred. He had not noticed any haloes. His mother had observed three years ago that the corneal diameter of both eyes was larger than normal. Numerous oculists had been consulted, but the proper diagnosis had not been made.

In the examination the vision was 20/15 in each eye. The visual-field finding was recorded as shown in figure 6a. The corneas measured 13 mm. in diameter, and the anterior chambers were deep. The external examination was otherwise without significant findings. Tension in each eye was 22 mm. Hg. In the fundi enlarged cups were seen, with a temporal pallor of the discs. The vessels were pushed somewhat to the nasal side. Gonioscopy of the right eye showed many pectinate remnants from about the 3- to the 12-o'clock position, and in the left eye scattered through the angle, with an area especially large at the 1-o'clock position. The angle was not obliterated and in between these areas the internal annular ring and the corneoscleral trabeculum were clearly seen.

On June 20, 1943, goniotomy was per-

formed on the right eye. One quarter of the chamber angle from the 3- to the 12-o'clock position nasally to superiorly was incised, and on June 28th the procedure was repeated on the left eye, the incision extending over one quarter of the chamber angle from the 9- to the 6-o'clock position, nasally to inferiorly. Following the incision in the right eye an excessive amount of blood appeared in the anterior chamber. This cleared completely in about two weeks, and no complications have resulted. Prostagmine was used postoperatively, and the tension has remained at about 11 mm. Hg. The patient has had no headaches since the operation.

Visual fields taken after the surgery are recorded as shown in figure 6b.

No discussion of these cases is needed, for the results are unmistakably clear.

With this new goniotomy lens the chamber angle could be seen as clearly, and over as wide an extent, as with the glass operating or gonioscopy lens. Two changes were made; namely, (1) the obliteration of the water chamber, which was not necessary for magnification, and (2) the reduction in size of the lens. The operation of goniotomy was now far easier, for during surgery with the aid of the glass lens, any manipulation of the eye, fixating or entering the cornea with the knife, caused bubbles to enter the

water chamber; thus vision was obscured at the crucial time. This hazard was now eliminated. Also it was not necessary to fill the water chamber with solution, as flooding the eye with saline provided sufficient fluid. The new lens lay directly on the cornea with only a thin layer of saline between the lens and the corneal epithelium; however the duration of the actual incision was so short that the cornea did not have time to become abraded or clouded, and as the lens was applied only once the actual damage was negligible. Experiments were conducted using other solutions between the lens and cornea. It was found that these were unnecessary, and their additional value of buffering action was counterbalanced by the danger of introducing the substance into the eye. Glycerine, castor oil, and other oils were used, but were discarded as without value. It must be emphasized that this modified lens is for surgical use only, not for the prolonged, methodical diagnostic examination necessary in each case of glaucoma.

#### SUMMARY

A new lens for goniotomy is presented, which, when applied directly to the cornea, greatly simplifies the operation. Three cases are described in which surgery was successfully performed.

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## SUPPRESSION VERSUS AMBLYOPIA\*

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When I began to consider this subject I decided that comparing suppression with amblyopia ex anopsia would be like comparing a cat with a tiger, both belong to the same family and spring from the same source, yet are unlike in their habits and temperaments and must be handled with a different approach.

The generally accepted definition of suppression (as I understand it) is the temporary suspension of seeing in an eye which ordinarily has good vision. The understanding which I have of amblyopia ex anopsia is a habitual suspension of vision which has become constant and thus caused poor visual acuity. The result in each instance is from a similar cause, the incoördination of the two eyes which, without the suspension of vision, would be sufficient to result in diplopia. To avoid the annoying diplopia the brain unconsciously brings about suppression, which if it is constant for any length of time becomes amblyopia ex anopsia. As Dr. H. M. Burian stated in his paper on "Fusional movements in permanent strabismus" (*Arch. of Ophth.*, Oct., 1941), "The urge to avoid disturbing double vision is strong. It is not necessarily a conscious effort. It is present even in small children, and suppression as well as amblyopia is caused by it." A good example of suppression in normal eyes is one's ability to use the ophthalmoscope or microscope without closing the second eye. One learns to ignore the image of the eye which is not using the instrument, a temporary monocular suppression. The eyes and brain do the same thing in squint as a protective mechanism against what

would be an upsetting diplopia, as any one knows who has had a paralysis of an extraocular muscle.

In considering suppression versus amblyopia I became interested in trying to find out if one type of squint might be more predisposed to either amblyopia or suppression than another and would fall into a definite pattern, or if squints happen to develop either suppression or amblyopia in a hit-or-miss fashion.

I have attempted to compare 38 cases of squint with equal vision (presumably using some form of suppression) with 38 cases of amblyopia (showing at least three lines' difference in vision in the two eyes). I have classified these as to muscle balance, esotropia or exotropia; as to hypertropia, right, left, or double; as to correspondence, true or anomalous; as to the refractive error, with special attention in cases of anisometropia as to whether the refraction was greater in the nonfixating eye or the fixating one. I have also compared the average age of the onset of squint in the two groups, and have determined ocular dominance.

In 38 cases in which there was equal vision in the two eyes (referred to as the suppression cases for convenience), 20 were cases of esotropia and 18 of exotropia. The amblyopic cases could be divided into 32 esotropias and 6 exotropias. From this it may be deduced that the incidence of esotropia combined with amblyopia is much greater than that of exotropia in combination with amblyopia. The number of esotropias and exotropias in the suppression cases was so nearly equal that it might point to a larger number of exotropias in cases of suppression, considering the fact that we

\* Read before the fourth annual Symposium on Orthoptics, at Chicago, October 10, 1943.

find a much larger number of esotropias than exotropias in the general run of squints.

In considering the hypertropias the suppression cases showed 4 right hypertropias, 10 left hypertropias, and 7 bilateral hypertropias, or a total of 21 with some form of hypertropia. The amblyopic cases showed 10 right hypertropias, 5 left hypertropias, and 8 bilateral hypertropias, a total of 23 with some form of

of true correspondence and 10 cases of anomalous correspondence, whereas the amblyopic cases presented 17 cases of true correspondence and 21 anomalous ones, or twice as many anomalous-correspondence cases in the amblyopias. Travers in his article "Suppression of vision in squint and its association with retinal correspondence and amblyopia" (Brit. Jour. Ophth., Oct., 1938) compared 148 cases of normal correspond-

TABLE 1

38 CASES OF SQUINT WITH EQUAL VISION COMPARED WITH 38 CASES OF SQUINT WITH AMBLYOPIA

	38 Cases of Suppression (Equal Vision)		38 Cases of Amblyopia	
	No.	Percent	No.	Percent
Muscle Balance				
Esotropia	20	53	32	84
Exotropia	18	47	6	16
R. Hypertropia	4	10	10	26
L. Hypertropia	10	26	5	13
Bilateral hypertropia	7	18	8	21
All hypertropia	21	55	23	60
Correspondence				
True	28	74	17	45
Anomalous	10	26	21	55
Refraction				
Hyperopia	14	37	7	18
Myopia	2	5	0	0
Hyperopia & Astigmatism	12	32	11	29
Myopia & Astigmatism	2	5	0	0
Mixed astigmatism	2	5	2	5
Anisometropia (with refractive error greater in nonfixating or amblyopic eye)	6	16	13	34
Anisometropia (with refractive error greater in fixating or nonamblyopic eye)	0	0	5	13
Average age of Onset of Squint	2 years 6 months		2 years 4 months	
	No.	Percent	No.	Percent
Dominant eye				
Right	13	34	16	42
Left	15	40	22	58
Alternate	10	26	0	0

hypertropia. This comparison showed such an even distribution of hypertropia between the two groups that it can be assumed in this series at least that hypertropia seems to have little bearing on the development of either one form or the other of suspension of vision.

The result of the comparison of the true and anomalous correspondence in the two types of cases is interesting. The 38 cases of suppression presented 28 cases

ence with 132 cases of abnormal correspondence and found that in 45 percent of the normal-correspondence cases there was equal vision, whereas in 64 percent of the abnormal correspondence cases there was equal vision. The 76 cases under consideration here compared in the same manner show 45 cases of normal correspondence, in 28 of which there was equal vision, or 62 percent against Travers's 45 percent, and 31 cases of abnormal

correspondence in 10 of which there was equal vision, or 32 percent, compared with Travers's 64 percent. I realize that the latter tabulated many more cases than are being discussed here, but even taking this into consideration it is difficult to understand such a disparity.

Travers has developed methods of mapping out the suppression field on the Bjerrum screen at 1 meter (with a transparent red celluloid shield over one eye of the patient) with a small electric lamp pinned on the screen in a position such that when the eye with the red covering looks at it, the other eye is directed at the central area of the screen. In this way the area is mapped out by having the patient tell when a 1-degree white test object appears red and when it appears white. With a reasonably coöperative patient it is possible to map out this suppression scotoma. Travers also describes a more elaborate method whereby two screens and a mirror are used with a white cross on the screen straight ahead, and a fixation light on the second screen to the side which is so adjusted that when the cover test is used there is no shift in changing fixation from the cross to the light. Travers states that squinters with normal retinal correspondence show little suppression when this test is used unless the visual acuity is low, but that patients with abnormal correspondence will not project the light in the center of the screen after being set objectively with the cover test and will usually show a larger area of suppression.

Dr. John Evans in his article "Scotoma associated with strabismus" (*Amer. Jour. Ophth.*, March, 1929) reports 16 cases of adults whose average age was 25 years, and who gave a history of squint, in which he tested the field by the binocular method with a test object of 0.25 mm. He found an average absolute scotoma 2 degrees in diameter coinciding with the

center of fixation and connected to the blind spot by angioscotoma. Dr. Luther Peter in his book "The extra ocular muscles" states that the central scotoma even when profound is a relative one, 2 to 3 degrees in diameter; and that there is a relative increase in the size of the normal blind spot, with the peripheral field in the amblyopic eye smaller than the field of the fixating eye. Dr. J. B. Feldman and A. F. Taylor, R.N., in their paper "Obstacle to squint training—amblyopia" (*Arch. of Ophth.*, May, 1942) studied 68 patients, some of them children with amblyopia associated either with or without squint, adults with amblyopia, some with normal eyes, and some who had had amblyopia and whose vision could be improved to 5/5 with glasses. They found a lower incidence of scotomas as compared with other surveys in the literature. Suppression areas, however, were common and might be found associated with squint without amblyopia. They concluded that a definite opinion regarding amblyopia could not be formed from fields, either as to diagnosis or prognosis, since the highest incidence of field changes which was obtainable was 20 percent.

Field taking in amblyopia is an intensely interesting subject, but one in which there are so many "ands," "ifs," and "buts," particularly in the case of young patients, that I am afraid many of us feel the urge to start doing something about the amblyopia rather than spend time trying to map out the scotoma or suppression area. In the 76 cases we are considering the field findings were not complete enough to be used in statistics.

The comparison of the refraction of these cases came next. The incidence of myopia, hyperopia with astigmatism, myopia with astigmatism and mixed astigmatism was not different enough in the two groups to be significant, but the sup-

pression cases presented 14 instances of hyperopia whereas the amblyopia cases presented only 7. There were 6 instances of anisometropia, with the refractive error greater in the nonfixating eye in the suppression cases, as compared with 13 of the amblyopic patients whose greater refractive error was in the eye with the poorer vision. The suppression cases included none with the refractive error greater in the fixating eye, whereas the amblyopic cases did present five in which the refractive error was greater in the nonamblyopic eye. The significant findings regarding the refraction would seem to be the higher incidence of hyperopia in the suppression cases and the fact that there were twice as many amblyopic cases with a greater refractive error in the nondominant eye compared with the suppression cases.

The average age at the onset of squint was 2 years and 6 months in the suppression cases; the amblyopic cases averaged only 2 months younger, 2 years 4 months. This difference could hardly be considered significant. Worth quoted figures stating that of those who attained 6/6 to 6/12 vision only 11 percent had squinted more than 50 percent of their lives, whereas 97 percent of those whose vision was below 6/60 had squinted for more than 50 percent of their lives. He presented strong evidence of the value of early treatment to prevent amblyopia and stated that with vision reduced to 6/60 in a patient over 7 years of age treatment is unlikely to produce any effect. In the article on amblyopia previously referred to, Dr. Feldman found that if the vision could not be improved when tested with a telescopic lens of  $3\frac{1}{4}$  magnification, the amblyopia never responded to treatment.

Dr. George P. Guibor (Trans. Amer. Acad. Ophth. and Oto-Laryng., 1942) stressed the importance of testing the visual acuity of children at 14 inches, be-

cause it enables the examiner to differentiate a true amblyopia from blurred vision caused by an overcorrection of the hyperopia or by an unrelaxed ciliary muscle. We have found many interesting cases among amblyopic patients under treatment in which the distance vision seems to make little or no improvement whereas the vision at near will improve as many as four or five sizes of type. This is helpful in making it possible for the child to read or play games with much more facility at the near point with the good eye occluded.

The final comparison made in these cases was in ocular dominance. The suppression cases presented 13 of right-eyed dominance, 15 of left-eyed dominance, and 10 alternators. The amblyopic cases presented 16 of right-eyed dominance and 22 of left-eyed dominance and, of course, no alternators. Drs. Walter Fink and Brynfelson (Arch. of Ophth., Dec., 1935), in considering "The relation of strabismus to right or left sidedness in 60 cases of convergent strabismus," found that 74 percent of the patients came from left-handed stock, and in 60 percent control had been shifted from the dominant to the less dominant side. These figures seem rather high but perhaps it is because we have failed to consider the question carefully enough in taking the case histories of squints, and it is interesting in this study that there was slightly more left-eyed dominance in both the suppression and amblyopic groups.

The treatment of amblyopia is, first and foremost, occlusion, as nearly complete and constant as the child's situation will allow. The child must be persuaded that making his lazy eye work is an important consideration for him. If he is available for office treatments, flashing on any of the orthoptic instruments while he is looking at bright pictures will help. Games like table tennis,



in which he will make an effort to see, are helpful. The movies can be recommended unless they are so exciting that the child will be tempted to use the good eye. Games which can be purchased in the 5-and-10-cent store are numerous: sewing cards, clay modeling, threading beads, painting, drawing and tracing books, and jig-saw puzzles, to mention a few. To a young child who has never had one, a small blackboard with colored chalk is fascinating, also an easel for finger painting will probably produce a budding Dahl in our midst. The prolific badly printed comic books may prove a boon, particularly for a boy who would have to be forced to sit down to read any other kind of book, and its worst feature, the poor printing, should be an aid in stimulating vision. If the child does not have sufficient vision at first to see to read ordinary type, a plus lens can be added in a clip-on to enable him to start the stimulation of the eye. Of course, as the amblyopic eye is being treated the occluded one should be checked every few weeks, as the vision in a constantly occluded eye may go down somewhat, particularly in young children. If anomalous correspondence exists in association with the amblyopia, the same occlusion is helping both conditions, but this should be explained to the parents, for they will otherwise be disappointed when the vision improves to find that occlusion is still necessary.

The treatment of suppression does not usually call for such drastic methods, and if the angle of squint is small, with no tendency to anomalous correspondence, occlusion is not generally indicated. In working with the patients on the various machines it may be necessary to dim the light before the dominant eye or to stimulate the suppressing one with flashing, but most patients who have equal vision will be able to fuse quite easily if conditions are made ideal for them. If the patient

can develop stereopsis that is a step forward of course, for no suppression is possible when depth is correctly perceived. The important consideration is getting the patient in a position to fuse in every day life as soon as possible either by exercises or surgery or both. When the patient has arrived at that happy state he can use a stereoscope with interesting cards, and if he shows a tendency to suppress an eye regularly the lens of the stereoscope before the dominant eye can be lightly smeared with soap. Bar-reading will be found helpful in some of these cases, and although this does not necessarily impose binocular vision, at least once in each line the patient has to use the two eyes, according to Dr. David Wells ("Controlled reading," *Amer. Jour. Ophth.*, June, 1932).

#### SUMMARY AND CONCLUSIONS

A survey of 38 cases of suppression compared with 38 cases of amblyopia seen in private practice shows:

1. A greater number of esotropias in association with amblyopia and a probably greater number of exotropias in association with suppression.
2. An equal distribution of hyertropias between the two groups.
3. A larger number of cases of true correspondence with equal vision and a slightly larger number of anomalous correspondence types in the amblyopic cases.
4. Fields in these series were not complete enough for analysis.
5. A higher incidence of hyperopia in the suppression cases, and in anisometropia twice as many amblyopia cases with the greater refractive error in the nondominant eye.
6. The difference of the average age of the onset of squint was only two months between the two groups, not enough to be of significance.
7. A slightly higher incidence of left-

eyed dominance in both groups.

In conclusion a few suggestions to be used in the treatment of amblyopia and suppression are made, as in this day of highly specialized trades and professions the binocular use of the eyes is a great necessity, which many of our young

would-be pilots have learned to their sorrow. Whatever we can do to start young children out on the road to correct binocular vision will be an insurance for their future happy lives and useful citizenship.

*35 East Seventieth Street.*

#### DISCUSSION

DR. BEULAH CUSHMAN (Chicago): I want to congratulate Miss Enos on the manner in which she has brought this problem forward for discussion, for although we do not have the answers to all the questions of suppression and amblyopia we may take up the problems with a new interest after talking them over.

Miss Gonzalez and I have been using the mirror-screen test as demonstrated by Travers and as Miss Enos described it. We have found it very satisfactory to demonstrate suppression in any part of the field with and without normal retinal correspondence and in amblyopia.

Scotomas were found in the suppressed areas, and the size of the scotoma depended on the visual acuity of the portion of the retina involved. The scotoma was small if the suppressed area was near the macula, and usually only a relative scotoma in the macular area. The scotoma was larger if the projected area was in the periphery of the retina with its poor visual acuity. The scotomas or the suppression areas disappeared as the eyes became parallel or vision improved; therefore, we have called them psychic scotomas. This psychic scotoma is a method of avoiding diplopia and confusion. It is a step further than retinal rivalry, the one eye becoming more dominant.

The suppression found in the so-called accommodative squints is probably the easiest to understand as it is purely ocu-

lar. The eyes become parallel with relaxation of the accommodative effort, with or without glasses, and the amblyopia in the poorer eye usually improves as it is stimulated and the suppression area disappears.

Other reasons for the development of suppressed areas may be found by studying the development of posture and visual projection. Duane quotes Lotze, who pointed out that the labyrinthine and neck muscles are the first and primary factors in the development of space localization. Visual projection and visual acuity come later in the child's development and are adjusted to the conditions present. If there is some ocular-muscle or refractive anomaly the head will be tilted and the eyes so directed as to overcome the confusion, and diplopia and suppression will develop in the areas necessary. In eyes with unequal or large refractive errors macular suppression may be necessary to avoid confusion, and amblyopia or poor vision remains.

Therefore, suppression may be the psychic attempt to avoid the diplopia and confusion as the associated refractive and muscular structure determine the area and depth of the scotoma. Amblyopia and suppression have their beginning always in early life, for we know that later in life, in eyes with good binocular vision and fusion, suppression can seldom be obtained should any ocular or muscular anomalies arise.

*25 East Washington Street.*

# THE ORTHOPTIC TREATMENT OF THE PHORIAS\*

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Admitting that the phorias are not difficult to treat, are they important? In private practice, we ophthalmologists must consider the problem seriously, since the patients in this group of "ocular imbalances" suffer the greatest amount of discomfort. They will seek out the physician who is consciously treating with means other than only glasses with prisms. The aviation industry has recognized the problem for several years; now industry in general has become conscious of its presence. The work of Prof. Joseph Tiffin and Dr. Kuhn proves that the accident increase definitely is associated with high esophorias for distance and high exophorias for near work. When industrial corporations are including the phorias, of course along with other visual factors, in the examination of all new employees, as well as taking the time to check the old employees, one is almost overwhelmed by the scope of such a program. Industry also is cognizant of the fact that it is far more economical to treat these employees than to train them for other types of work. Certainly it is a virgin field for the present group of orthoptists and presents a good future for one interested in this field of endeavor.

What procedure is to be followed in treating the phorias? First, a careful physical examination, particular attention being paid to the possible foci of infection, such as carious teeth, diseased tonsils, faulty habits of elimination; also the drinking habits. Digressions from the normal have to be corrected before any mode of treatment will be satisfactory. These factors are so important for success that

I do not think it unethical for the orthoptic technician to suggest the possibility of such an existing condition when she finds a "slower than normal response" over a prescribed period of time. A physician has never lost a patient by repeating an examination but he has lost patients by not doing it carefully in the first place or failing to repeat his work when a question has arisen that justifies a careful recheck. Following a thorough examination and refraction, a course of treatment is outlined to the orthoptist and the patient. Home treatment alone, even under the ophthalmologist's supervision, is not advocated. Few, if any, physicians have either the temperament or the time necessary to devote to the details of instruction and procedure that are required. I have obtained excellent results and a most satisfactory patient relationship working in conjunction with a well-trained technician. Under her observation and guidance, the patient is much less apprehensive, more at ease, his interest is sustained, and full coöperation is secured. In this manner, the office procedure and home work are closely supervised, and faulty habits are quickly eliminated.

Complications of the phorias, such as alternating or monocular suppression, present in many of the exophorias for near and convergent insufficiencies, have to be broken down before the ductions can be improved. This can be done satisfactorily with the red glass and the reading bar. With the complication cleared away, the phorias are best treated with a major amblyoscope. In exophorias and convergent insufficiencies, we use the flag series which have print to stimulate accommodation, believing that we can build up ductions more rapidly in this way.

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\* Read before the fourth annual Symposium on Orthoptics, at Chicago, October 10, 1943.

Later, we replace the stereoscopic slides, using the smaller targets. In esophorias and hyperphorias, we use stereoscopic slides exclusively. Once the patient understands what is expected of a normal pair of eyes, home treatment with prisms and graded stereoscopic slides can be satisfactorily employed. In the simpler convergence insufficiencies, approximation exercises alone are adequate to relieve symptoms. However, in all forms, I believe stereopsis is an added benefit which promotes a more permanent result. The uncomplicated exophorias require 6 to 10 treatments to build up sufficient normal duction power. The hyperphorias require a longer time and vary more in their response to treatment. One should be most

cautious of committing himself to any stated time factor in any type of case.

The standards taken for the discharge of a patient are normal duction balance, fusion, and stereopsis.

In closing, I should like to say that the orthoptist treating phorias should have the opportunity of reexamining these patients to observe how completely comfortable and symptom free they have remained.

### CONCLUSIONS

1. "Phorias" are important.
2. They respond readily to treatment.
3. They form a group of your most satisfied patients.

*435 Fifth Avenue.*

### DISCUSSION

ELSIE H. LAUGHLIN (Iowa City): Dr. McCaslin admits that phorias are not difficult to treat. In comparison with tropias this is true, as many heterophorias are asymptomatic and require no treatment. On the other hand, some cases may require surgery and prisms before symptoms are relieved.

In our experience there are at least two important factors in determining ocular discomfort. The first is the relationship between the amount of heterophoria and the patient's reserve of fusional power after overcoming it by fusional movements. It is not uncommon to find asymptomatic patients with large degrees of heterophoria. They are not uncomfortable because they have a reserve of fusional movements. For example, a routine aviation examination revealed that a pilot had 8 to 12 prism diopters of hyperphoria with cover test and Maddox rod. He was able to overcome this deviation easily; consequently, he had no complaints, single binocular vision, and stereopsis according to standard tests.

A second factor is occupation. Recently in our clinic an analysis was made of heterophorias in two large occupational groups: farmers and university students. The incidence of ocular discomfort in association with heterophoria was many times greater in the student group, although the incidence of heterophoria was only slightly greater.

There are other factors, but in the average case of heterophoria the part played by poor health habits and foci of infection is controversial, although no one will question that systemic disability is important in some cases. Dr. McCaslin has stressed the necessity of making a careful examination before orthoptics is prescribed. Members of our medical staff question the need for a general physical examination and check for foci of infection in every case.

The necessity for careful refraction cannot be overemphasized. For example, we find a considerable number of convergence insufficiencies associated with uncorrected or undercorrected myopia. In

many of these patients, convergence ability improves when the full myopic correction is prescribed; consequently, it has been our policy to give them a trial of several weeks or months with proper glasses before initiating orthoptic training.

I agree with Dr. McCaslin that in an occasional case accommodation may be an aid in developing convergence, but routinely I find it simpler to teach patients to converge without accommodating; that is, with the instrument adjusted for infinity. Usually there is less fatigue and therefore better toleration of convergence exercises. In some cases it is essential to teach convergence without accommodation; for example, in convergence insufficiency in patients wearing bifocals.

Our technique with all convergence insufficiencies, then, is to begin with simple targets on the major amblyoscope. The rotor control of flashing tends to stimulate recovery as well as steady fusion. Many people follow a moving object well to an acceptable convergence near point, but recovery of a single image at any point after fusion has been disrupted is the crucial test and more nearly parallels the patient's subjective experience. Another advantage of the major amblyoscope is that the eyes and position of the head can be watched constantly.

When the simple targets are mastered, they are supplemented with stereoscopic charts in which stereopsis is an added incentive for fusion. The "jump" targets of the Keystone Delta Base Out series are especially good and may be used in the prism stereoscopes.

The results obtained with orthoptic

training in uncomplicated convergence insufficiency are excellent. Often associated hyperphoria and cyclophoria of small degrees are lessened when horizontal fusional movements are well developed.

I agree with Dr. McCaslin that it is unwise to commit oneself to a stated time factor in any type of case but the greater share of our patients, like his, obtain relief with 6 to 10 treatments.

Probably no profession finds its terminology more confusing than that of orthoptics. In a recent article Dr. Lancaster has called our attention to the importance of establishing standard terminology to avoid confusion. For example, it is not quite clear in my mind just what Dr. McCaslin means by duction balance as a requirement for discharge. According to Dr. Lancaster, ductions refer to monocular rotations whereas vergences describe the fusional movements which are developed by orthoptic training.

Lastly, I would like to mention a group of phorias who are the orthoptist's pride and joy—patients whose tropias have been converted into phorias by orthoptics properly combined with the correction of refractive errors, occlusion, and surgery. They require more treatment than the ordinary heterophoria before comfortable binocular function is maintained under all conditions. However, the fact that these patients have reached the phoria stage is evidence of good coöperation between ophthalmologist, patient, and orthoptist. Without this coöperation, orthoptics would be a much less gratifying field of endeavor.

*1630 Wilson Street.*

# NONCOMITANT HYPERPHORIAS

## CONSIDERED AS ABERRATIONS OF THE POSTURAL TONUS OF THE MUSCULAR APPARATUS

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The role of the postural tonus of the extraocular muscles in the physiology of vision has been stressed in a previous communication.<sup>1</sup> There it was pointed out that the fusion-free position, in which one eye fixates while the other is occluded, does not represent a true position of rest and that therefore concepts which have been arrived at through the use of the conventional clinical tests are not safe guides to follow in determining the diagnosis or the treatment of a given case.

The process of fixation is accompanied by minute, rhythmic, involuntary adjusting movements which serve to prevent retinal fatigue by permitting the foveal image to roam over a large number of perceptive elements, while at the same time maintaining accurate fixation. The latter is thus associated with a state of heightened tonus affecting all of the extraocular muscles. The fact that prolonged fixation frequently results in symptoms of eyestrain bears evidence to the validity of this statement.

Physiologically considered, the closest approach to a position of rest of the eyes in the waking state would be a vacant stare into space, no attempt being made to discern any objects. However, such ocular posture is of little practical value, since it does not offer a base line from which quantitative clinical measurements may be made.

Since binocular vision arose at a fairly late stage of phylogenetic development, it may be assumed that even in man there are present potential tonus-regulating centers which control the postural muscle-tonus of one eye without reference to the

other. Superimposed upon these are the centers controlling binocular innervation, both the tonic and the kinetic varieties. In the normal exercise of binocular vision the monocular influences are held in abeyance, being completely inhibited by the higher centers. Hering's law of equal binocular innervation applies only to those latter centers.

Two types of eye movements are typically associated with an archaic postural pattern. One is divergence, which is reminiscent of the laterally placed eyes in lower mammalia. The other is an upward deviation which may be considered a protective movement and is still normally present as Bell's phenomenon, elicited by closure of the eyelids.

The divergence movement has already been dealt with in the communication to which reference has been made.<sup>1</sup>

In all individuals there is present a potential tendency toward an upward rotation of the visual axes which increases with any increase in the general tonus of the muscular apparatus. Fixation provides such an increase in muscle tonus. If both eyes are fixating, no movement is, of course, possible. However, if one eye, for any reason, does not participate in the visual act, that eye may manifest the up-drift. Following are some of the conditions under which this phenomenon may be elicited: (1) Occlusion of one eye. (2) Amblyopia or blindness of one eye. (3) Lack of development of fusion. (4) Obstacles to fusion, such as anisometropia, heterophoria, and aniseikonia.

The amount of hyperphoria present in the nonfixating eye will also depend on

the extent to which the binocular innervation has supplanted and inhibited the more primitive monocular tonus-controlling centers, and on the degree of dissociation achieved by the clinical method employed. The Maddox rod produces more dissociation than a red glass, unless the latter is dark enough to reduce the intensity of the muscle light to a mere glimmer, in which case it is as effective as the Maddox rod, or even more so. The longer monocular occlusion lasts, the greater will be the amount of hyperphoria thus elicited.

It should, however, be noted, that many clinically normal cases, on prolonged occlusion, exhibit analogous phenomena. On occluding one eye for one week, that eye may be found to have developed a hyperphoria. On repeating the procedure on the other eye, the occluded eye need not show a corresponding amount of hyperphoria, but may even exhibit a hyperphoria, or an exophoria, or a combination of the two. It is interesting that Marlow,<sup>2</sup> who had advocated his prolonged-occlusion test as an important diagnostic aid, later<sup>3</sup> admitted that it merely produces artifacts which bear no relation to the normal physiology of the ocular movements.

The two most widely circulated theories are the one of White,<sup>4</sup> who ascribes the hyperphoria to a paresis of the superior rectus of the opposite eye, and that of Bielschowsky,<sup>5</sup> who regarded the hyperphoria as a disjunctive vertical deviation arising in some mysterious way from an inequality in the stimulation of the two retinas.

If there is one single characteristic that differentiates a noncomitant hyperphoria from either the comitant or the parietic type, it is the fact noted by Bielschowsky, that the higher eye, even behind a screen, responds with a downward movement whenever a dark glass is placed in front of the fixating eye. This behavior defi-

nitely establishes the existence of a relationship between the visual processes of the fixating eye and the muscle balance of the nonfixating eye. Bielschowsky interpreted this phenomenon to mean that the reduced illumination of the retina of the fixating eye results in a disjunctive "vertical divergence." This explanation is purely hypothetical, besides seeming rather forced.

To the writer's knowledge, the view that regards the noncomitant hyperphorias as a synthesis of the primitive monocular tonus-regulators and the higher binocular innervation, has not been stressed either in textbooks or in the literature.

The present communication will be limited to a consideration of two types of hyperphoria; namely, alternating hyperphoria and monocular hypertropia of amblyopic eyes.

#### ALTERNATING HYPERPHORIA

In patients having normal binocular vision, alternating hyperphoria is frequently encountered either as the sole anomaly or combined with other heterophorias. It may exist in combination with a comitant hyperphoria, in which case the comitance is modified so as to suggest the presence of a muscle paralysis. If the Maddox rod is held before one eye, the hyperphoria is different in amount from what it would be were the rod placed before the other eye. However, the absence of diplopia and the uniformity of the deviation in the various portions of the field of fixation help to differentiate this type of hyperphoria from a lower neuron paralysis. The hyperphoria is entirely abolished or greatly reduced in amount by convergence and accommodation.

A curious case was observed recently in a young soldier who had a congenital amblyopia of the right eye, the vision in this eye being 20/60. The left eye had



normal vision. Both eyes were on the same level when fixating binocularly. Convergence and accommodation were normal. When the right eye was screened, it turned sharply upward 15 degrees, to return to the normal level when the screen was removed. When the left eye was screened, no movement, either up or down, was noted in either eye. The hyperphoria of the right eye was the same in all fields of fixation. This case may be explained as a combination of a comitant right hyperphoria and an alternating hyperphoria. It may also be regarded as a transition stage to the type of noncomitant hyperphoria seen in blind or amblyopic eyes.

#### THE BIELSCHOWSKY PHENOMENON

If one eye is either blind or markedly amblyopic it frequently displays a hyperphoria of varying degree. In these cases, and even in those in which no hyperphoria exists, Bielschowsky was able to demonstrate that the blind eye makes a quick downward movement of about 10 degrees when a dark glass is held before the fixating eye. Even if the dark glass is left in place, the blind eye will slowly return to its former, or almost its former, position. Bielschowsky explained this behavior by assuming that the reduction of illumination of the retina of the fixating eye produces a disjunctive binocular innervation with a resulting vertical divergence. The deviation manifests itself only in the blind eye, since the other eye cannot relinquish fixation. Cords<sup>6</sup> has designated this type of noncomitant hyperphoria as "Bielschowsky's phenomenon," a term which seems appropriate in view of the obscure nature of the physiology involved.

An analogous phenomenon is observed in alternating hyperphoria. On screening either eye, the covered eye turns upward. If now, without changing the position of the screen, a dark glass is held in front

of the fixating eye, the other eye makes a downward movement behind the screen.

#### AUTHOR'S THEORY

In a study of a large number of cases of alternating hyperphoria and Bielschowsky's phenomenon, the author has made the following additional observations.

1. If a screen is held in front of the fixating eye, the other, blind eye, makes a downward movement exactly as if a dark glass had been used. An intelligent patient can be easily trained to keep the screened eye in the same position even though fixation is temporarily suspended through the interposition of the screen. This test is more difficult to carry out in alternating hyperphoria, but there the same findings are obtained.

2. If a lighted electric bulb is used as the fixation object and the light is extinguished, no appreciable effect on the hyperphoria can be detected.

3. The interior of the eye may be illuminated by light thrown through the pupil without altering in any way the response to the screening of the fixating eye.

4. By holding a black card in front of both eyes in alternating hyperphoria, or before the good eye in Bielschowsky's phenomenon, so that the fixation reflex is either eliminated or rendered ineffectual, the deviation is found to be greatly reduced in amount or entirely absent.

These observations permit the following deductions to be made:

1. Fixation is at least as important a factor in producing the deviation as the illumination of the fixation object.

2. The deviation varies with the visual activity and not with the amount of light striking the retina.

3. Elimination of the fixation act reduces or even abolishes the hyperphoria.

It appears from clinical observations as well as from the theoretical considerations

discussed in the previous communication<sup>1</sup> that the eye muscles are subject to two types of tonus innervation: (a) The tonus derived from the voluntary nerve supply, which is invariably bilateral and symmetrical; and (b) the reflex postural tonus, dependent on such factors as fixation, illumination, and attention. Fluctuations in attention may play a part in the irregular up-and-down movements that are frequently observed in the blind eye while the other eye stares at a fixation object. At any rate, whatever the cause may be, these spontaneous oscillatory movements reflect the continuous play of tonus-regulating forces upon the entire musculature of the eye.

Fixation and illumination tend to heighten the tonic activity (tension) of all eye muscles. In all persons there exists a tendency—archaic in origin, as expressed in Bell's phenomenon—for the eyes to turn upward. The greater the muscle tonus, the greater this upward drive becomes. In a large percentage of people the binocular linkage is loose enough to permit a greater or lesser degree of dissociation of the two eyes. Naturally, when one eye has been blind or amblyopic since childhood, the binocular functions are rudimentary and the dissociation is quite marked. Hence, fixation by one eye results in a tendency to upward deviation of both eyes, this tendency becoming manifest only in the nonfixating eye, and only to the extent that the laxity of binocular innervation permits. It may be easily seen that by prolonged monocular occlusion the maximum degree of dissociation is obtained, and it is not surprising to find vertical deviations in a majority of cases, differing in degree and in kind, depending on which is the occluded eye.

An interesting thought suggests itself in this connection, though not bearing directly on the subject at hand. Miners' nystagmus is induced by absence of fixation and lack of light, and it is inhibited

by convergence. These factors are the same as enter into the genesis of alternating hyperphoria. Fixation is associated with rapid, minute, involuntary adjusting movements. When the factors affecting muscle tonus are reduced to a minimum, it is conceivable that these adjusting movements become so slow and coarse as to deserve to be classed with nystagmus.

Since fixation by one eye is a relatively primitive function, it may produce a primitive tonus-response which, like Bell's phenomenon, is originally a protective reflex, and does not necessarily bring the binocular motor apparatus into play. When, however, higher visual requirements are thrown upon the ocular apparatus, such as fusion, convergence, or accommodation, this primitive reflex tonus is inhibited and perfect binocular function is established. This state of affairs may be observed in alternating hyperphoria. Even if either eye may drift upward spontaneously on distant gaze, the hyperphoria is inhibited on convergence and accommodation.

#### SUMMARY

1. Alternating hyperphoria and non-comitant hypertropia of blind or amblyopic eyes (known also as Bielschowsky's phenomenon) have been variously interpreted as due to superior rectus paralysis and as a "vertical divergence" elicited by visual processes.

2. An attempt has been made here to explain these conditions as aberrations of the postural tonus-mechanism of the extraocular musculature.

3. According to this concept, voluntary binocular control of ocular movements has been superimposed upon an archaic tonus-regulating pattern that does not obey Hering's law, and that manifests itself to the extent to which any laxity of the binocular linkage will permit a dissociation of the two eyes.

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## ON THE MORBIDITY OF TRACHOMA

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A characteristic of every infectious disease is its morbidity; that is, the sick rate, or proportion of disease to health in a community in which every member has the opportunity to be infected. Most infectious diseases show a wavelike change of morbidity; for example, influenza is supposed to have a peak in every 30 years, diphtheria in 8 to 10 years. We do not know about such oscillations in trachoma. Its occasional spread is due to the greater possibility of contact infection. In this way trachoma was contracted by soldiers partaking in the Napoleonic campaign in Egypt in 1798-99, and they spread it in several European countries after returning to their homes. Such a spread can be observed on a small scale when the migratory laborer infects the members of his family. He contracts the diseases from his fellow laborer in the summer. This mode of infection has a great significance in Hungary. According to data I collected at the University Eye Clinic in Pécs, Hungary, 23 percent of trachomatous patients contracted the disease from other agricultural laborers and 33 percent acquired it from members of their own families. The same observation has been made in another part of Hungary, as in the county of Mezökövesd, where also the two main sources of

trachoma are the family and the group of agricultural laborers.

Our knowledge of the morbidity of trachoma is somewhat meager, although there are abundant statistics on the distribution of trachoma. Twenty-five reporters contributed statistics at the Thirteenth International Ophthalmological Congress at Amsterdam,<sup>1</sup> 1929, concerning the distribution of this disease throughout the world. Wibaut<sup>2</sup> collected these data and made a trachoma map of the world, for which he deserves our gratitude. However, the figures of the map are based on the study of very different groups, nine in all; for example, distribution of trachoma among school children, recruits, samples of population, and in eye clinics.

Only if every member of a community has the opportunity to become infected is it possible to determine the morbidity of a disease. This is easy in the case of measles or influenza, for these spread through serial infection; moreover, a single exposure is sufficient to contract them. Trachoma, on the other hand, being a contact disease, spreads in communities whose members live continuously and intimately together. It is probably only exceptionally contracted from a single exposure. Such communities are found

among the poorest farmers in southeastern Europe. Each family uses the same washbasin and towel, sleeps in two beds, and lives in one or two rooms. There is a very great possibility that the infection is spread from the diseased eye by the fingers, handkerchief, by water used for washing pillows, and so on. In Mezökövesd (northeastern Hungary) I examined 12 families infected with trachoma, and found 41 members out of 70 suffering from the disease (58.5 percent). But these families, because they were so severely affected, were purposely selected by the local trachoma doctor. In the same village practically all the inhabitants have been examined by the local physicians. In two districts—one half of the village—308 (33.9 percent) out of 908 members of 165 families suffered from trachoma. Data collected from trachoma patients treated at the University Eye Clinic, Pécs, Hungary, showed 137 (34.4 percent) out of 398 members of 76 families as diseased. In trachoma-afflicted families it may take several months or years before another member of the family shows signs of trachoma. In this series only those individuals could be examined who came to the Clinic. The condition of other members of the family was necessarily determined by the testimony of those examined, and that is very unreliable. Even the reports of these previous investigations in Mezökövesd, where diagnosis was made by several physicians, do not give the real number of diseased persons. We know there is no single symptom that determines the diagnosis of trachoma beyond doubt. In all such examinations the personal equation of the examiner must be considered.

In a second series of investigations this factor was excluded by considering only families whose members had inclusion bodies. In addition to trachoma, these are found in the paratrachoma diseases: inclusion blennorrhea, inclusion conjuncti-

vit, swimming-pool conjunctivitis. But these diseases can be differentiated from trachoma. Swimming-pool conjunctivitis is contracted in pools; inclusion blennorrhea of the newborn cannot be confused with trachoma, because the newborn has no trachoma. The only paratrachoma disease to be confused with trachoma is inclusion conjunctivitis of the adult, but this disease is rare, acute, and for the most part monocular. Thus, if inclusions are found in the conjunctiva in a case of chronic conjunctivitis in a trachoma country, the disease is considered to be trachoma, even if the clinical symptoms are doubtful. Excluding the paratrachoma diseases, the finding of inclusion bodies makes the diagnosis of trachoma certain. Seventy-one (42.3 percent) out of 168 members of 28 inclusion-positive trachoma families suffered from the disease.

Some other statistics available also throw light on the morbidity of trachoma in Hungary. Lénard<sup>3</sup> examined the whole population of several severely infected villages and found the incidence of trachoma cases to be as follows: Tót-szentmárton 35.5 percent, Molnári 35 percent, Sömjénháza 33 percent. He also found 1,509 cases (30 percent) out of 5,079 inhabitants of the county of Letenye, the southwestern corner of Hungary. These are the most heavily infected villages in that country, and nearly all the families are involved. The percentages show strong resemblance to the figures found by us.

The situation is a different one in Egypt. It is known that practically all the natives acquire trachoma. Wilson<sup>4</sup> (1929) examined the inhabitants of the village of Bahtim. Out of the total population of 3,540, 491 could not be reached and 140 were under one year of age. Those examined showed the following condition of conjunctiva. Trachoma I, 20.6 percent; Tr. II, 1 percent; Tr. III, 72.4 percent; Tr. IV, 3.6 percent; acute

conjunctivitis 2.4 percent. Subtracting this last group, which might contain trachoma cases as well, all persons examined were diseased. Twenty-five percent of the babies under one year of age showed trachoma. It can be stated that trachoma has a morbidity of 100 percent under the social, climatic, and racial conditions of Egypt. Searching among the data of reports prepared for the Amsterdam Congress, only the paper of Miyashita<sup>5</sup> (Japan) gives statistics concerning the distribution of the disease in the families, and number of diseased families in a village.

These statistics indicate (supposing the

filth, and over crowding." These conditions are very different in different countries.

The main source of infection with trachoma is the family. This mode of spreading the disease causes the hardest problem in the fight against it. The measures generally accepted are fairly effective, such as periodic examination of school children and recruits, treatment, hospitalization, and so on, but the main source cannot be reached unless the general welfare and hygiene of the poorest is improved. Wibaut<sup>2</sup> summarizes it in this sentence, "the countries most affected are the poorest."

Author	Number of Examined Families	Number of Infected Families	Percentage of Infected Families	Percentage of Trachoma among the Population of the Village
Maruo	998	470	47	14.1
Kumamoto	502	363	72	31.4
Wakisaka	100	80	80	43.6
Nara	4,695	3,791	81	48.3
Aomori	89	76	85	48.8

number of members in families with and without trachoma to be the same on the average) that 30 to 60 percent of the members of trachoma families suffer from trachoma. From another table given by Miyashita, showing data from the same writers, the family incidence is about 30 to 50 percent.

It remains a subject for discussion, whether the nonafflicted members have an absolute or relative immunity. Some of the individuals may have an abortive form of the disease. Another group is exposed to infection at an advanced age, when immunity seems to be higher. Trachoma is more easily contracted by a child than by an adult. The abundant lymphatic tissue of the child, and its atrophy in the adult may have an influence on that fact. As to the role of race, I quote MacCallan<sup>6</sup> "No race of mankind is immune from trachoma, all suffer equally when exposed to the same conditions of contagion,

The most important measure in the fight against trachoma is its treatment. A few years ago it was to be hoped that sulfanilamide was the specific drug, but by now over two scores of publications show a wide divergence of opinion concerning its effectiveness. The first publications were enthusiastic about its specific action, but by now several are skeptical of its curative effect, and others admit that only a small number of patients respond to sulfanilamide. Julianelle and J. E. Smith<sup>7</sup> subjected trachomatous tissues *in vitro* to different concentrations of sulfanilamide. The tissues were then tested for infectivity. "Under these conditions, it was not possible to demonstrate that sulfanilamide has any appreciable effect on the infective capacity of the virus of trachoma." Very correctly they remark that "conditions *in vitro* are not identical with those *in vivo*," although, under their experimental set-up,

very similar. On the other hand, it seems to be highly significant that the inclusion bodies disappear from the conjunctiva in three days, when the patient is treated only with the drug *per os*, as Thygeson<sup>8</sup> found to be the case in 16 instances of inclusion-positive trachoma patients. In this part of the country trachoma is very rare. In 5 years, the author has seen only three inclusion-positive trachoma cases. In all three cases there were no inclusions to be found on the fourth day, after sulfanilamide administration only, without any local treatment, thus confirming Thygeson's observation. In six weeks the trachoma was cured clinically in all three cases. The drug was given for two weeks, with an interval of one week. Six weeks seems to be a long time for a cure by a "specific" drug, but it cannot be expected that the deep histologic changes of the conjunctiva, lymphocytic and plasmacellular infiltration, follicles, and papillary hypertrophy would disappear as soon as the infective agent is destroyed.

The same is true for the disappearance of luetic changes under specific treatment. Spirochetes disappear from the primary luetic lesion in 48 hours, when the patient is treated with arsenicals, but it takes several weeks before the lesion is healed; and this is in the acute stage of the infection. It takes about two months before a gumma clears up under specific treatment. If the inclusion body is the con-

glomerate of the virus, or if it indicates the presence of the virus, and thus the infectivity of the case, it is to be hoped that sulfanilamide or some even more effective sulfa drug will prevent the spread of the disease. An inclusion-positive trachoma case should be hospitalized for the first series of sulfanilamide treatments.

### SUMMARY

Only in communities in which members of families live under very crowded and poor hygienic conditions, can the real sick rate of trachoma be determined, because of the chance of repeated and massive contacts. The morbidity is 100 percent in Egypt, 30 to 60 percent in Japan, and was found to be 30 to 58 percent in Hungary, 42.3 percent in inclusion-positive trachoma families. Certain individuals and old persons have a relative immunity, but no race is immune from trachoma. The main source of trachoma is the family, and in southeastern Europe the migratory laborer.

General welfare and hygiene help in the fight, as is well known. But the most important weapon is the treatment. The disappearance of the inclusion bodies from the conjunctiva in a few days, when sulfanilamide is administered, makes us hope that the infectivity of the individual can be quickly suspended, and thus the danger he represents be eliminated for family and country.

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# NOTES, CASES, INSTRUMENTS

## SIMPLE EQUIPMENT FOR DETERMINING OCULAR-MUSCLE EFFICIENCY

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Phorias may be uncovered and measured and fusion efficiency evaluated in various ways. The following equipment and techniques have been employed by the writer for the past 10 years. The equipment is compact and inexpensive and

peep hole is employed in the "peep hole" or "pinhole" test preliminary to refraction, to determine whether or not vision is correctible. The screen itself serves as an ordinary eye screen to exclude one eye when testing monocular vision, and the like.

The shoulder and the axis of the Maddox rod are set at an angle of 45 degrees to the long axis of the screen. This position permits the examiner to rest his fingers conveniently against the side of the examinee's face and temple, thereby

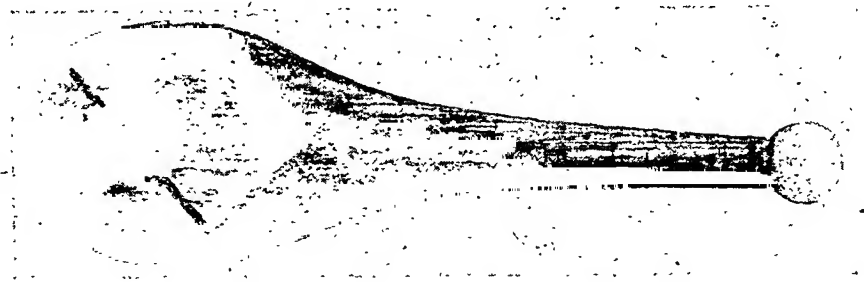


Fig. 1 (Thorne). Eye screen with Maddox rod.

the technique is sufficiently accurate for all routine ocular-muscle-efficiency tests.

The equipment consists of a red multiple Maddox rod encased in a wooden eye screen (fig. 1) and a set of loose, square prisms. In addition to the multiple Maddox rod the eye screen is equipped with a handle, the end of which terminates in a white ivory sphere; a V-shaped shoulder below the Maddox rod to support the prisms and assist in the proper placement of same, and a peep or pinhole 1 mm. in diameter. The white sphere is employed for fixation purposes and rough visual-field determinations, and so forth. The shoulder serves as a support for the prisms employed to measure the phorias uncovered and obviates the necessity of closely scrutinizing the prisms and screen to insure proper placement. The 1-mm.

steadying the screen. The position of the line of light is indicated by a white line on the face of the screen, which is at right angles to the axis of the Maddox rod. This line assists the examiner in holding the shield at its proper angle before the eye and is perceptible in a moderately darkened room.

The shield is inexpensive and practically indestructible. If a sufficient number of these shields were placed in each eye-examination unit, all personnel on duty therein could be provided one and each carry it as he does his fountain pen.

Inch-and-a-half square loose plastic prisms are recommended in preference to glass prisms of the same size, as the plastic type is not easily broken. It is true the plastic prism scratches easily, but a considerable amount of scratching can be



inflicted before the prism becomes ineffective. Prisms in strength from 0.5 to 12 diopters are sufficient for all routine muscle-efficiency tests. Round prisms from the trial case may be employed in connection with this shield, but accurate placing of round prisms is more difficult than with the square type, as they are designed to be used in a trial-lens frame. In addition to measuring the degree of phorias uncovered, the square prisms are employed in measuring the efficiency of fusion.

The eye screen with its Maddox rod and square loose prisms can be conveniently carried in a single case constructed for the purpose. With the exception of a spot lamp the entire ocular-muscle equipment will then be contained in a single case approximately  $2\frac{3}{4}$  by  $2\frac{3}{4}$  by 6 inches in size.

*Office of the Surgeon General.*

### MOTILITY CLINIC\*

#### CONCOMITANT CONVERGENT STRABISMUS WITH OVERACTION OF THE INFERIOR OBLIQUE MUSCLES AND DISSOCIATED VERTICAL DIVERGENCE

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Miss A. McC., aged 16 years. Very soon after her birth the parents noticed that her eyes turned in alternately. Particular attention was paid to this, since there was a history of strabismus on both the paternal and maternal sides of the family. The patient was examined for glasses at an early age; the refractive error was found to be low; no correc-

tion was given, but the left eye was bandaged for some time.

Eight years ago the patient's neuromuscular condition was thoroughly checked for the first time. Visual acuity was normal in each eye; refraction: R.E. = L.E. = +1.00D. sph.  $\approx$  +0.50D. cyl. ax.  $90^\circ$ . An alternating convergent strabismus of 20 to 22 arc degrees (40 to  $45^\circ$ ) was found. The position of the double images in the double-image test corresponded to the angle of squint, and the afterimages in the afterimage test formed a cross (normal retinal correspondence). Adduction in the right eye was excessive and the patient appeared to prefer the left eye for fixation. A guarded tenotomy of the right internal rectus muscle was performed by Dr. Bielschowsky with excellent result.

Certain features which complicate this simple picture were noted when the patient was first seen; they have not changed to this day.

### DIAGNOSIS

At present the refraction and visual acuity are: R.E. -0.50D. sph.  $\approx$  -0.75D. cyl. ax.  $15^\circ = 20/20 -2$ ; L.E. +1.25D. sph.  $\approx$  -0.50D. cyl. ax.  $180^\circ = 20/20$ . The wearing of the glasses does not noticeably influence the position of the patient's eyes, but it gives her comfort for close work and at the movies.

The patient appears to have binocular fixation for distance; the right eyeball is, possibly slightly protruding. However, at times the right eye turns slightly in and up; occasionally, though much more rarely, the same happens with the left eye (fig. 1).

*Rotations.* When the patient looks to the right there is a slight restriction of the adduction of the left eye, but at the same time that eye makes a definite upward movement; the abduction of the right eye is normal (fig. 2A). In levover-

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sion there is a restriction in the adduction of the right eye, more pronounced than on the other side, and also an upward movement of the adducted eye; the abduction of the left eye is normal (fig. 2B). The movements in all other directions are free, except that in looking up and right and up and left the adducted eye makes a much larger excursion upward than does the abducted eye (figs. 2C and 2D). In this case the convergent strabismus is complicated by an *overaction of the inferior oblique muscles* of both eyes, resulting in an excessive upward movement of the adducted eye.

This is not a rare occurrence. In some of the patients the overfunction is so marked that it necessitates a myectomy of the inferior oblique muscle.

This particular case shows very well to what the overaction is *not* due. It is not an *apparent* overaction, simulated by a weakness of the superior rectus muscle



Fig. 1 (Burian). Primary position.

of the abducted eye, since the elevation of the abducted eye is perfectly normal (figs. 2C and 2D). Nor can the overaction of the inferior oblique be the result of a weakness of the superior oblique; the depression of both eyes in adduction is normal, indeed, if anything, somewhat excessive (figs. 2E and 2F). Finally, it cannot be due to the action of a skew insertion of the internal rectus muscle, since both internal rectus muscles are underactive rather than overactive. It is quite clear that this case presents an actual enlargement of the field of fixation of

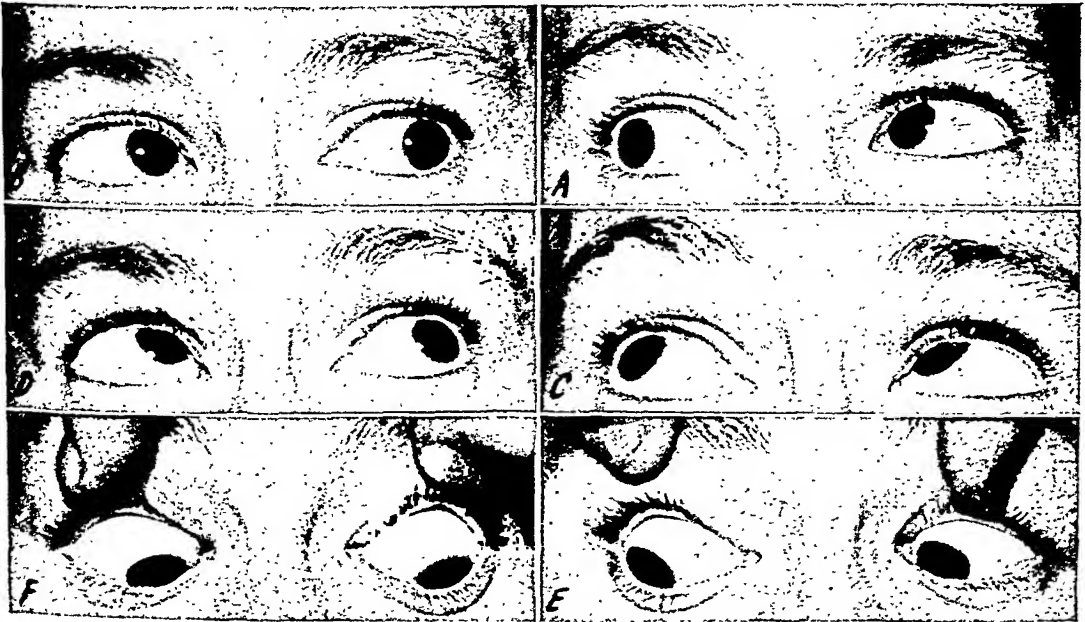


Fig. 2 (Burian). A, *Dextroversion*. Adduction O.S. slightly deficient; marked overaction of the left inferior oblique muscle. B, *Levoversion*. Adduction O.D. deficient; overaction of right inferior oblique muscle. C, *Looking up and right*. Same as A. D, *Looking up and left*. Same as B. Note that there is no deficiency in the action of either superior rectus muscle. E, *Looking down and right*. Excursions normal, except for deficient adduction O.S. F, *Looking down and left*. Excursions normal, except for deficient adduction O.D.

the adducted eye in elevation and adduction; an actual and typical overfunction of the inferior oblique muscles.

**Cover test.** The patient fixates the light in the center of the tangent scale. The right eye is covered, and after removing the cover a slight outward movement of the right eye is apparent. But this outward movement is somewhat concealed by a slow *downward* movement of the eye. Immediately after uncovering it, the right eye is definitely higher. It stays in this position for a moment and then slowly turns down, possibly even somewhat below the horizontal plane. The left eye



Fig. 3 (Burian). A, Immediately after uncovering the right eye: The right eye is higher than the left. B, Immediately after uncovering the left eye: The left eye is higher than the right.

also shows a slight outward movement and a slow *downward* movement in the cover test. However, it is apparent that the left eye makes a wider sweep downward than does the right eye. When the eyes are alternately covered, the eye which assumes fixation moves slightly out and very noticeably downward. This downward motion is very slow unless the opposite eye is covered, in which case the downward motion is speeded up. In other words, under cover each eye turns in and up; the left eye going farther up than the right eye (fig. 3). Such an elevation of *each eye* under cover must not be confused with a hyperphoria. It is a

dissociated movement which Bielschowsky designated as *dissociated vertical divergence*.

In measuring the angle of squint with prisms, the horizontal movement of the eyes is stopped with a prism of  $10^{\Delta}$ , base out, but the dissociated vertical movement still persists. This vertical movement cannot be stopped by adding prisms, base down or up, in front of the eyes. It is impossible to determine the amount of the dissociated vertical divergence by means of the cover and prism test. This test cannot be applied to the measurement of the dissociated vertical divergence.

**Double-image test.** With a dark-red glass in front of the right eye, the patient reports that the red image of the fixation light of the tangent scale is at 5 arc degrees to the right and 6 arc degrees below the center light. With the red glass in front of the left eye she sees the red image 5 arc degrees to the left of the fixation light and 12 arc degrees below it. These at first somewhat baffling results of the double-image test are easily explained by a simple analysis. The uncrossed diplopia indicates that the patient has normal retinal correspondence and that the distance of the double images corresponds to the residue of the convergent strabismus of 5 arc degrees. The vertical diplopia—simulating both a right and left hyperphoria—shows that there is a dissociated vertical divergence. The fact that the vertical distance is larger when the red glass is in front of the left eye indicates that in addition to the dissociated vertical divergence there probably exists in this case a left hyperphoria which happens to be of the same amount as the dissociated vertical divergence; namely, 6 arc degrees.

**Examination for binocular vision.** On the synoptophore the patient has an objective and subjective angle of squint of about  $10^{\Delta}$  of esotropia with first-degree

targets. The patient is able to fuse second-degree targets and has fusional amplitudes of from 7 to 12<sup>A</sup> of convergence to 3 to 5<sup>A</sup> of divergence. She has third-degree fusion, but there is considerable suppression of the right eye.

In the stereoscope the patient fuses properly and has up to 60 or 70 percent stereopsis with the graduated Keystone DB<sub>6</sub> chart.

It is unusual to find such a high degree of binocular coöperation in a patient whose horizontal strabismus began at a very early age, who had a rather large angle of squint up to the age of eight years, and who has, in addition to the horizontal, a marked and complicated vertical muscular imbalance. It is not surprising that she loses fusion at the slightest provocation.

#### SUMMARY

This patient has had since birth an *alternating convergent strabismus* with a large angle of squint. In spite of that she has preserved the normal sensorial retinal relationship. The horizontal deviation is complicated by vertical disturbances consisting of three components: An *overaction of both inferior oblique muscles*, a *left hyperphoria*, and a *dissociated vertical divergence*. Notwithstanding the severe handicap, the patient has most of the time binocular vision and a fair amount of stereopsis.

The characteristic features presented by this patient are not always displayed so clearly as they are in her case. But it is mainly through the study of pronounced cases that one learns to improve one's diagnostic ability.

It is of importance for the therapy to make the diagnosis of dissociated vertical divergence. This is best done by using a dark-red filter in conjunction with the tangent screen, and placing the filter always alternately in front of either eye.

It will not be discovered if the filter—or the Maddox rod—is placed routinely in front of only one eye, say the right. If a dissociated vertical divergence is mistaken for a right or left hyperphoria, prisms may be given or even an operation performed. The dissociated vertical divergence is, however, a purely innervational anomaly which is not accessible to therapy by prisms or operation.

#### REFRACTION CLINIC\*

DISCUSSION BY ALBERT E. SLOANE, M.D.†  
Boston

A 24-year-old lady, a bookkeeper, who had never worn glasses complained of blurred near vision after prolonged work. She stated that the print tended to run together and that she could make herself see clearly by either rubbing or closing the eyes with force. She volunteered that it was probably the lighting which was the cause of her difficulty.

#### EXAMINATION

The first examination revealed:

Vision O.D. 20/30. With a +2.00D. sph.  $\approx$  - .50D. cyl. ax. variable it was 20/20—3 to 20/20. Vision O.S. 20/30. With a +2.00D. sph.  $\approx$  - .50D. cyl. ax. variable it was 20/30—3 to 20/20.

It was found that one could not be sure of the axis of the cylinder since the subjective test showed a varying choice of axes from time to time. Retinoscopy seemed to indicate with-the-rule astigmatism (—axis 180°) but this was not always acceptable to the patient. Since spasm of accommodation must have been causing the varying findings, homatropine was ordered and examination to be made on another day. The second examination under cycloplegia showed:

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Vision O.D. +2.75D. sph.  $\approx$  - .50D. cyl. ax.  $150^\circ$  to  $30^\circ = 20/30$ ; O.S. +2.75D. sph.  $\approx$  - .50D. cyl. ax.  $135^\circ$  to  $180^\circ = 20/30$ .

Even under these conditions one could not be sure of the axis, which varied as much as 60 degrees, when trying to place the cylinder in its proper meridian. It was then decided to check the patient on a morning when she had not used her eyes. The third examination revealed:

O.D. +2.25D. sph.  $\approx$  - .50D. cyl. ax. variable; O.S. +.25D. sph.  $\approx$  - .50D. cyl. ax. variable.

You will note that again the proper axis could not be satisfactorily ascertained. The swinging-cylinder test did not agree with the cross-cylinder check nor with itself on repeated trials.

The phoria test was made with a +1.50D. sph. in place and was found to be: distance, 2<sup>A</sup> esophoria, vertical orthophoria; near, 2<sup>A</sup> exophoria.

## DISCUSSION

A 24-year-old person with symptoms referable to her work is presented. It is the patient's suggestion that poor lighting is the cause of her difficulty. We may limit the discussion to three phases:

(1) *The muscle balance of the two eyes.* Note that there is only 2<sup>A</sup> of esophoria present for distance with no vertical imbalance and only 2<sup>A</sup> of exophoria at near. This certainly lies within normal limits and should be excluded as a cause of the patient's complaints.

(2) *The physical environment from a standpoint of lighting.* It is true that inadequate illumination can cause asthenopic symptoms, but the complaints are usually those of fatigue and general discomfort rather than of periods in which the vision is clear and then blurs and then can be made clear again by shutting or rubbing the eyes.

(3) *The refractive error.* Certainly

there is enough hypermetropia to produce symptoms at near and yet allow fairly good distance vision, because at this patient's age the accommodation is active. It would readily appear that the hyperopic error alone can well explain the symptoms. A perplexing situation is introduced by the disclosure of a definite amount of astigmatism as found by three refractions and yet an inability properly to establish the position at which this astigmatism should be corrected. While this occurrence is relatively rare it does happen sufficiently often to make its management a problem. It seems that some people cannot discern the best position for a correcting cylinder when there is an associated substantial spherical error that has heretofore been unrecognized. Under such circumstances it is best to ignore the astigmatic correction and prescribe only for the spherical component. Almost inevitably, such a person will be able to give an accurate determination of his astigmatism shortly after he has worn his spherical correction for a time. It is generally true that it is better to correct only the astigmatism that a patient manifests on subjective tests rather than an astigmatic error that is discovered objectively and that the patient persistently rejects subjectively.

## SOLUTION

I should order +1.50D. sph. for each eye and ask the patient to return after an interval of not more than one year for a reexamination and before that if there are symptoms. I should tell the patient that full correction cannot be given at this time and for this reason the earlier-than-usual second visit will be necessary.

## QUESTIONS

House Officer: Do you not find that with cylinders of even this order (0.50D.) the patient will frequently be unable to

decide the exact axis within 30 degrees?

Dr. Sloane: In errors wherein the spherical component is high, such as over 4.00D., I should expect difficulty in finding the axis within 15 degrees, but in errors wherein the spherical component is 2.00D. or less, the patient can generally pick his axis within 10 degrees. Usually he can pick it almost "on the nose" if he has worn glasses before and his vision is good. Have you never seen a person with an error of +2.00D. cylinder who has never worn glasses before and could not make a choice of axis within an amplitude of 15 degrees yet after having worn his glasses for a month or so, could select his axis exactly? (This makes one feel almost stupid in having failed to get the proper axis at the first visit.)

243 Charles Street.

## CAPILLARY HEMANGIOMA OF PALPEBRAL CONJUNCTIVA

### *PATHOLOGIC REPORT*

OTIS D. WOLFE, CAPT. (MC), A.U.S.  
Fort Riley, Kansas

Although hemangiomata are considered neoplastic in nature, it is generally conceded that the predisposing condition is present at birth, even if the tumor itself is not.<sup>1</sup> Consequently, they are most often seen in young people and are especially common in the newborn. Hemangiomata of the conjunctiva are rather uncommon in adults, and, when encountered, one often obtains a history of a small "birth-mark" which had been present for months or years and then began to grow rather suddenly.

The following case is reported, not because hemangiomata of the conjunctiva are rare, but because, in this case, the history of onset was unusual and misleading.

Only pertinent points in the history and examination are included.

The patient was a white male, aged 21 years. He presented himself at the Eye Clinic with the request that a "chalazion" be removed from the lower lid of the right eye. The growth was first noted four months previously at which time there were pain, redness, and swelling of the area. Within a period of not more than two days he noted a small "lump" which could be felt through the skin. The acute symptoms subsided rapidly; however, the localized "lump" persisted but caused him little discomfort.

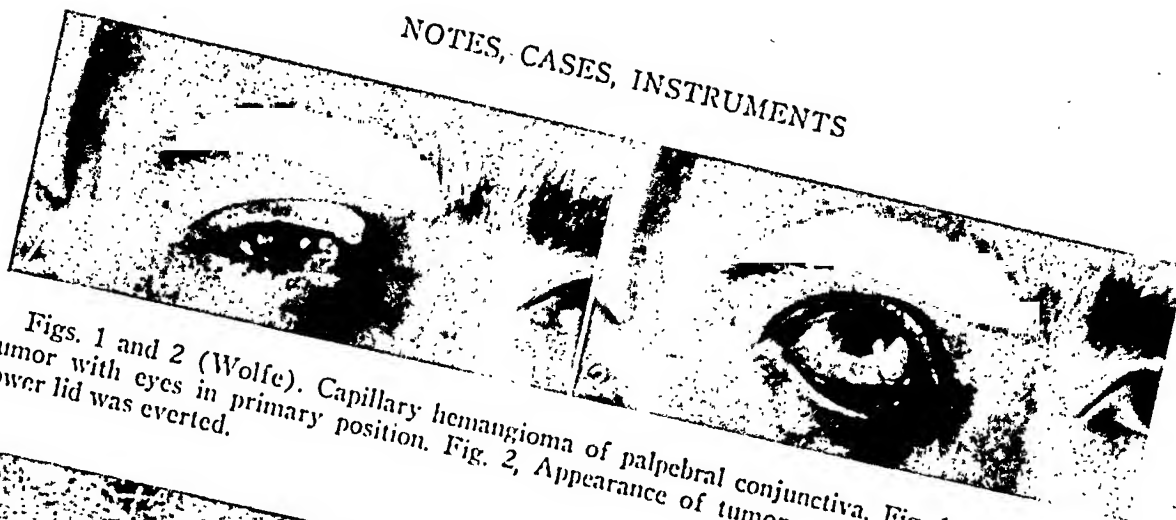
The growth increased in size gradually over a period of approximately four months, and this resulted in mechanical impairment of vision. Also a mucous discharge was present for the first time.

The past medical and family history was irrelevant. The patient felt certain that there had been no growth nor other abnormality of this lid previous to four months ago. He had had an "ordinary chalazion" on the upper lid of the right eye which had been surgically removed approximately a year ago through a horizontal skin incision. The onset of this older growth was similar to the present one, but following the initial acute stage he was free of symptoms. The growth had been removed for cosmetic reasons. The patient stated that he had had a total of five chalazia but that only the one had been surgically removed. None of these had occupied the site of the present one. He gave no history of trauma to the conjunctiva or lid area.

*Examination.* A soft, bluish-red, globular mass, which readily changed its shape on manipulation of the eyelid, was observed in the palpebral fissure of the right eye. It rested snugly between the free border of the lower lid and the infero-nasal quadrant of the cornea and bulbar conjunctiva (fig. 1). The surface was covered



## NOTES, CASES, INSTRUMENTS



Figs. 1 and 2 (Wolfe). Capillary hemangioma of palpebral conjunctiva. Fig. 1, Appearance of tumor with eyes in primary position. Fig. 2, Appearance of tumor when patient looked up and lower lid was everted.

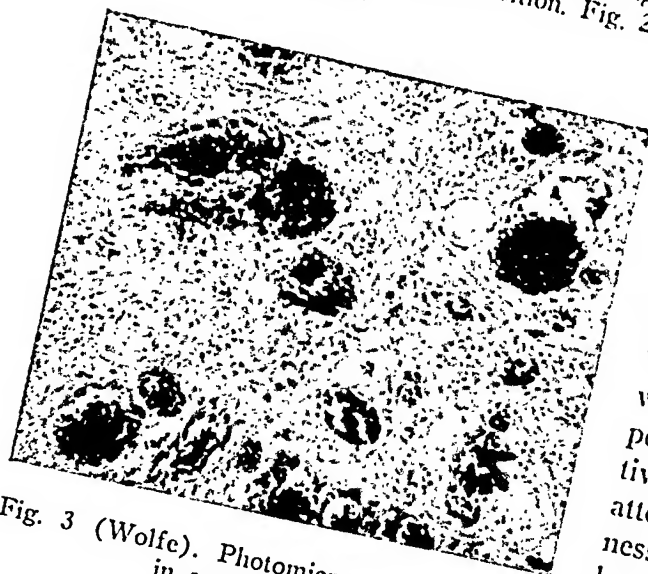


Fig. 3 (Wolfe). Photomicrograph of tumor in section ( $\times 100$ ).

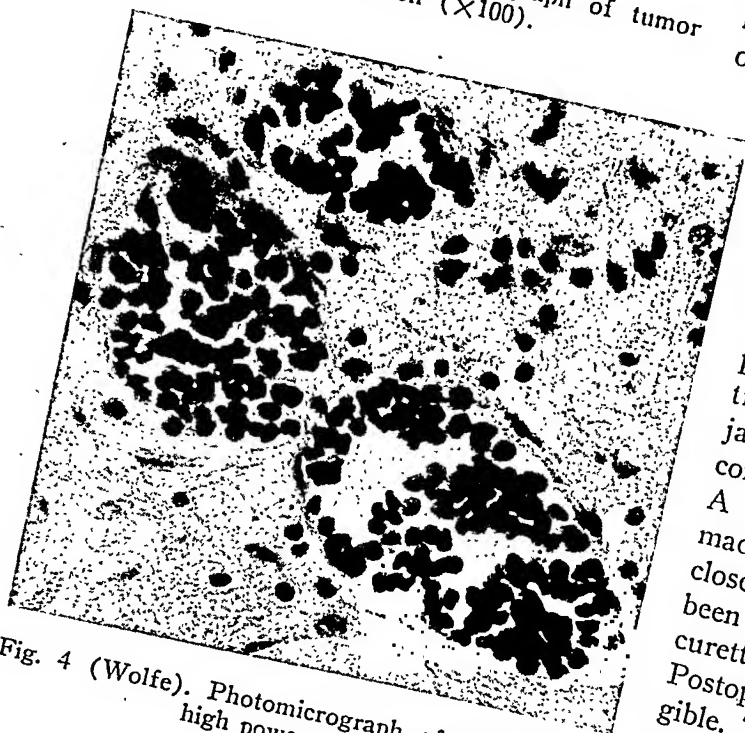


Fig. 4 (Wolfe). Photomicrograph of tumor under high power ( $\times 470$ ).

with mucus; there were no ulcerations. When the lower lid was everted the mass was seen to arise from the palpebral conjunctiva midway between the free and attached border of the lid, about 5 mm. temporal to the lower punctum (fig. 2). The mass measured 6 by 5 by 3 mm. and was firmly attached by a short but broad pedicle to the underlying tarsal conjunctiva. Compression of the mass was not attempted. There was no apparent tenderness. The surrounding bulbar and palpebral conjunctivas were injected and the limbal vessels between the 3- and the 7-o'clock positions were moderately engorged. The cornea was clear and did not stain with 22-percent fluorescein.

*Treatment.* Pontocaine 0.5 percent was instilled locally. The infra-trochlear and infraorbital nerves were anesthetized with 2-percent procaine. Procaine was also infiltrated into the lower cul-de-sac adjacent to the tumor. Bleeding was controlled with a chalazion clamp. A vertically elliptical incision was made on either side of the tumor close to its base. After the mass had been excised, the base was gently curetted. No sutures were used. Postoperative bleeding was negligible. The eye was covered with an eye-pad, but the patient was directed to remove the eye-pad when he returned to his barracks.



The patient was reexamined five days postoperatively. He reported that there had been no untoward reaction during this period. He was last seen approximately six weeks following the excision. At this time he was confined to the hospital with measles, so that a photograph was precluded. The conjunctiva was perfectly smooth and there was no evidence of residua or recurrence.

**PATHOLOGIC REPORT** (*figs. 3 and 4*).

*Gross:* The specimen consists of an injected polypoid, epithelium covered growth 6 by 5 by 3 mm. in size, with a smooth surface. The interior is soft in consistence and of a homogeneous dark-brown color. The whole specimen is used for blocking. *Microscopic:* The section

consists principally of loose, fibrous connective tissue that is heavily studded with small, thin-walled blood capillaries, all of which are congested. The fibrous tissue, is young, and numerous fibroblasts are present. Throughout the section there is a dense infiltration by all types of inflammatory cells, principally lymphocytes and monocytes; plasma cells toward the central portion of the section and polymorphonuclears around the periphery. There is no evidence of the presence of rhinosporidia. (Examination for rhinosporidia had been specifically requested.) *Pathologic diagnosis:* Capillary hemangioma of the conjunctival surface of the right lower eyelid with acute inflammation.

**REFERENCE**

- <sup>1</sup>Duke-Elder, W. S. Textbook of ophthalmology. St. Louis, C. V. Mosby Company, 1938, v. 2, p. 1798.

# SOCIETY PROCEEDINGS

EDITED BY DONALD J. LYLE

## ROYAL SOCIETY OF MEDICINE

### SECTION OF OPHTHALMOLOGY

March 12, 1943

MR. FRANK A. JULER, *chairman*

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#### TUBERCULOSIS OF THE CONJUNCTIVA

MR. S. H. BROWNING (for Mr. Harold Ridley and Mr. Williams) presented a 29-year-old woman who complained of an ulcer on the lower lid which was first noticed in December, 1942. It was a punched-out ulcer, with hard edge, on the inner third of the lower lid of the left eye. There was a yellow patch on the bulbar conjunctiva where the ulcer touched. In the course of about one month the ulcer, as such, healed. The condition was obviously tuberculous.

Sections of a portion of the conjunctiva showed typical tuberculous giant-cell systems and Ziehl-Neelsen's stain showed tubercle bacilli. Guinea-pig inoculation was positive and the tubercle bacilli were found to be of human type.

*Discussion.* Mr. O. G. Morgan said that he had seen three or four cases of this type in which the infection had been with the human form of tubercle bacillus. They were accidental infections and not part of a general tuberculous condition, and were treated locally with ultraviolet rays; two of the patients were sent to a sanatorium for six months, where they had general treatment and additional therapy with ultraviolet light. All of them had enlarged preauricular glands, which were either aspirated or opened. In two

of them he removed all the coxcomb conjunctiva very thoroughly, and he thought that they all recovered. The local condition certainly improved, and, as far as he was aware, there was no spread to a general tuberculous infection. He felt that there was a vast field for sanatorium treatment in these cases. He had also sent to the sanatorium three or four patients who, on account of chronic relapsing bilateral iridocyclitis, had lost one eye and whose other eye was definitely failing. He regarded this condition as tuberculous, although actual tests could not prove it, and he was quite convinced that these patients showed greater improvement in a sanatorium than would have been possible had they been treated as out-patients.

Mr. Lindsey Rea said that he remembered a case of a young girl who had disseminated tuberculous lesions on the eyelids, face, fingers, wrists, and ankles. She was sent to Rollier's Sanatorium at Leysin for two years. There at 5,000 feet above sea level and in brilliant sunshine she greatly improved, and she lived for 19 years afterwards. Rollier gave intensive sunlight treatment to the everted eyelids for 10 minutes every day.

In another case of a boy with a tuberculous eyelid there was a gland beneath the mandible. Excising the gland was considered at the time but the boy was treated only for the eye condition which healed. However, the gland in the neck afterwards broke down, producing a running sinus for years. The patient, shown by Dr. Browning, had inflamed glands which she did not like to have touched. He urged that she be sent to a sanatorium to get as much sunshine as possible.

Mr. P. M. Moffat said that he had a similar case which proved to be tuberculous. The patient was a 14-year-old boy who was sent to Hayling Island for treatment. After six months he returned and was practically normal. Concerning the transmission of the condition from one tuberculous subject to another, he had seen an interesting case seven or eight years ago in which a girl had, what was clinically, a primary chancre of the lip. This subsequently proved to be tuberculous. Her fiancé was found to be suffering from active tuberculosis of the lungs.

Mr. Juler said that he had seen several cases of primary tuberculosis of the conjunctiva which improved under local treatment. In one case a subepithelial roll in the fornix was dissected. Patients with ulceration were scraped and, on the whole, improved. Personally, he was afraid of large doses of tuberculin.

Mr. Harold Ridley said that there was no sign of tuberculosis elsewhere in his patient. The latter was seen by one of his colleagues who suggested that the infection had been caught from farm animals. Whether it was a true case of Parinaud he could not say.

#### THE CONTROL OF OCULAR PAIN

MR. CHARLES B. GOULDEN said that there is considerable difficulty in controlling the pain produced by glaucoma, iritis, and cyclitis. The pain is frequently prolonged and if it is to be controlled by the administration of drugs, requires their frequent administration. The use of morphia is undesirable as it carries the risk of initiating a deplorable habit.

Pain from superficial lesions, such as abrasions of the cornea, can usually be controlled by the use of a local anesthetic and a pad and bandage. The pain of iritis may be reduced by the subconjunctival injection of air, as introduced by Magitot in 1912. The air must be injected

liberally by a syringe and a fine needle above, below, and to the right and left so as to cause a large area of emphysema. But the effects of the procedure have a short duration and other means of alleviating pain have to be found.

Two methods are available: (1) *Anesthesia of the sphenopalatine ganglion*, which is produced by the injection of novocaine into the posterior palatine canal with a needle 30 mm. long. The effect of the injection is immediate but the action is not very prolonged. Alcohol is not a safe substitute for novocaine. Blepharospasm and photophobia disappear, the eyes open, and there is no more pain. (2) *Intraorbital injection of alcohol*, which was introduced in 1930 by Weekers of Liège because of its sedative action. There is no difficulty in carrying out the injection, and there is no danger provided that the procedure is carefully done. There is needed a 2-c.c. syringe and a needle 40 mm. long, some 4-percent solution of novocaine, and 40- to 60-percent ethyl alcohol. The needle used must be fine, with a short point that must not be too sharp, so as to avoid injury to the optic nerve or orbital veins. It must be inserted 6 mm. below the middle of the external palpebral ligament, through the skin of the lower lid, the point directed toward the sphenoidal fissure through the muscle cone. It must not be inserted more than 30 mm., so that the point may not reach the sphenoidal fissure which lies 10 mm. deeper. The piston of the syringe should be slightly withdrawn to make certain that a vein has not been pierced. One cubic centimeter of a 4-percent solution of novocaine is injected. This will diffuse around the ciliary ganglion in exactly the same manner as a retrobulbar injection of novocaine. The needle is left in place and, in five minutes, 1.5 c.c. of 40- to 60-percent ethyl alcohol is injected. This does not cause pain and its sedative effect

is almost immediate. One effect of using too deep an injection, which reaches the sphenoidal fissure, is the paralysis of one or more extraocular muscles. The external rectus muscle is most frequently affected. However, the action of the muscle returns completely in about six weeks and the paralysis causes no inconvenience as the affection of the eye, for which the injection is given, is of equal duration. This accident may be avoided by not inserting the needle deeper than 30 mm., and not pushing it too much inward or outward.

Alcohol injections are most valuable in: (1) acute or subacute primary glaucoma; (2) the pain of cyclitis whether associated with hypertension or not; and (3) glaucoma associated with intraocular hemorrhage with blood staining of the cornea. In children with interstitial keratitis it not only relieves the misery of the pain and photophobia but it certainly has a beneficial effect upon the progress of the disease. Since the extreme congestion of the eye is aggravated by the blepharospasm, its relief reduces the redness of the eye and shortens the course of the disease. The injections may be repeated if necessary, but the relief given lasts at least a week and often for several weeks.

*Discussion.* Mr. O. G. Morgan said that the cases which he himself had treated in this way were cases of blind painful eyes, chiefly as the result of very long-standing glaucoma. The eyes looked perfectly good and one did not want to remove them. He had treated four cases, and the immediate effect of the injections was rather disheartening because it resulted in very great edema, chemosis, much pain, involvement of muscles, and loss of skin sensitivity. He had used absolute alcohol, which was employed by the neurologists for the injection of the Gasserian ganglion. Two of these cases had eventually done perfectly well. A third had improved after a second in-

jection. A fourth case was not successful and the patient refused to have another treatment.

One patient was a woman, aged 46 years, who had had a traumatic cataract needled when she was 23 years old. He first saw her in 1938, when she had bare perception of light with poor projection and poor tension. In 1941, she ran into a post in a blackout, and this resulted in the development of a large vitreous hemorrhage. She had very great pain which continued for about nine months. The question arose as to whether he should remove the eye or try alcohol injections. He first injected novocaine, and then 1.5 c.c. of absolute alcohol as close as he could get to the ciliary ganglion. For the next 48 hours the patient had extreme pain, great chemosis, and swelling over the eyelid. This continued until the third day. In addition there was anesthesia down the side of the nose and in the face. She had almost no movements of the eye. There was paresis of the extraocular muscles, and the only movement that remained was a very slight action of the external rectus. The condition gradually became less acute. Slight up- and downward movement of the eye returned, and the anesthesia of the face completely disappeared. Two months later she returned and stated that she had no pain. Excepting for slightly restricted adduction she had full eye movements. There was no anesthesia in the face and it seemed that there was likelihood of keeping the eye.

A second patient, very similar to the first, also had paresis and anesthesia of the skin. Of the four cases three were ultimately successful. One patient was unimproved and enucleation of the eye was necessary.

Mr. Morgan felt that it was probably unnecessary to use such strong alcohol and that 60-percent solution would be sufficient.

Mr. A. J. B. Goldsmith said that he could recall serious trouble in only one case. The patient was an 84-year-old lady who had an absolute glaucomatous eye. He had used 80-percent alcohol, resulting in edema of the lids and much chemosis. The pain was relieved after the first few days, but recurred and the eye had to be excised. Behind the eye there was a collection of pus; a swab of this was sterile. Probably the strong solution of alcohol had caused a fat necrosis with a secondary sterile abscess formation.

Mr. Lindsay Rea said that in the case of an 84-year-old lady he would use retrobulbar injection of novocaine with a curved needle and remove the eye. However, he thought that in other cases there must be a very great indication for use of alcohol.

Colonel Derrick Vail (MC), A.U.S., said that in the United States a few ophthalmologists had practiced this method since 1930. From his personal experience with this method, it was the only one which worked in a diabetic patient, aged 65 years, with bilateral acute glaucoma and a high degree of vascular hypertension. By means of alcohol injection she was tided over the acute stage of the pain, but before surgery could be undertaken, she had died.

Dr. Edward F. Wilson stated that in cases of hemorrhagic type of glaucoma the operation of cyclodiathermy should be tried. He had performed this operation on one patient, and the relief from tension and pain was immediate.

Mr. George Black said that he thought there might be a place for this method in the treatment of Mooren's ulcer. These were cases in which, in the final stages of the disease, there was much pain, and treatment had to be palliative.

Personally, he was rather dubious about the large-scale use of alcohol in the treatment of painful eye conditions. It must have a destructive effect as an

extreme degree of destruction had, in fact, been shown in some cases. In other cases, though the degree of destruction was minor, considerable anatomic disorganization might be caused with possible trophic changes in the cornea or other tissues of the eye. He felt, however, that in suitable cases the treatment, in some way, broke down a vicious circle. These were congested eyes, with brawny edema at the margin of the cornea. A notable consequence of alcohol injection in these cases was the rapidly increasing pallor. It seemed to him that a vicious circle associated with hypervascularity was broken by the injection of the alcohol, and subsidence of the vascularity led to brightening of the cornea and healing.

Mr. R. E. Bickerton said that in the old days the treatment of Mooren's ulcer was by extirpation of the lacrimal sac and was invariably effective.

Colonel Tovell (MC), A.U.S., said that as an anesthetist he had had some experience with the injection of alcohol, more particularly in the injection of the sciatic nerve for the treatment of sciatica. He said that if it was desired to retain motor function not more than 40-percent alcohol should ever be used. He had used pontocaine in the usual concentrations. Pontocaine being 10 times as potent and, therefore, 10 times as toxic as novocaine, one should be absolutely sure that the absorption was not too rapid, otherwise convulsions might occur. The treatment of convulsions was by means of oxygen under intermittent pressure. If the convulsions are of such intensity as to produce spasm of the diaphragm one could not introduce oxygen under pressure. Under the circumstances there should be preliminary treatment with pentothal in order to relax the spasm.

Mr. C. B. Goulden, in closing, said that he had expected the question of possible injury to the optic nerve would be raised. He did not think that such

an accident had been reported. He had been using this method since 1937. He had learned it from Magitot in Paris. Its chief value was in cases of acute glaucoma. It could be done even in the out-patient department before admitting the patient into the ward for surgical procedure. If it was necessary to remove the eye the use of alcohol was of value because the patient, as had been said, was tided over the few days before excision took place, and he was made free of pain at once. It was a most useful method for overcoming pain in interstitial keratitis. It certainly shortened the length of the attack, probably because the blepharospasm was overcome.

## NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

April 5, 1943

DR. ISADORE GIVNER, *presiding*

### THE FUNDUS OCULI IN HYPERTENSION AND ALLIED DISEASES

DR. MARTIN COHEN discussed this subject during the instructional hour.

### RESULTS OF THE SURGICAL TREATMENT OF LUETIC OPTIC ATROPHY DUE TO CHIASMAL ARACHNOIDITIS

DR. LOUIS HAUSMAN analyzed 23 cases of syphilitic arachnoiditis of the optic chiasm and nerves which were operated on for the freeing of adhesions.

*Clinical picture:* Progressive loss of vision, primary optic atrophy, and evidence of syphilis. In many of these cases the pupils were Argyll Robertson. In some, there were neurologic signs of tabes dorsalis in the extremities. In others, there were no neurologic manifestations other than those referable to the eyes—certainly no signs of tabes. Most of the patients developed blindness (3/200 to light perception) in one or both

eyes in two years or less. As a rule, the onset of visual impairment was gradual, although in three cases it was acute. The visual fields showed various defects: Marked irregular constriction, central scotoma, and sector defects. In only a few cases did the visual fields reveal the characteristic picture of a chiasmal defect. The duration of syphilis before the onset of the visual disturbance was known in 10 cases; it was congenital in one and varied between 7 and 30 years in the remaining.

*Laboratory examinations:* The cerebrospinal fluid showed an increase in cells in 11, increased protein in 9, and a paretic colloidal gold curve in 2 cases. The roentgen examination of the skull and the air encephalograms threw no new light on the problem.

*Treatment before operation:* Most of the patients had received either inadequate or no antiluetic chemotherapy before the onset of the visual disturbance. However, after the onset of the visual impairment, most of them had been adequately treated with arsenic and bismuth, and 10 had received fever therapy in addition. Nevertheless, these measures failed to arrest the progressive loss of vision in all cases.

*Operation:* In the 23 cases reported, the optic chiasm and nerves were explored. The usual frontal approach was used to expose these structures. Weblike or dense adhesions were found around the optic chiasm and nerves in all cases but one; in the latter the arachnoid was unusually tough and adherent. The adhesions and adherent arachnoid were freed by blunt dissection.

*Results:* The postoperative vision was as follows: In one case visual acuity was restored to 16/15—3 in both eyes, although before operation it was light perception in one and 20/100 in the other; at the end of three years this improvement had been fully retained. In six cases

vision was improved sufficiently to permit the patient to work and get about alone. In three the visual improvement was slight but insufficient to enable the patients to get about by themselves. In two, who had no light perception, there was no improvement. In five the visual loss was not arrested; the result was poor. In three the results were inconclusive. In two there were fatalities, meningitis, and pneumonia with pneumococcus meningitis occurring after the operation.

In summary, Dr. Hausman stated that syphilitic optic atrophy is associated with arachnoiditis, of varying degrees, around the optic chiasm and nerves. Of the 23 operative cases, 10 patients showed improvement in vision, although with adequate antiluetic therapy they had been getting progressively worse up to operation. Of these 10 cases, 5 had been treated unsuccessfully with malaria in addition to salvarsan.

*Discussion.* Dr. Morris Davidson said that in his special field of activity he rarely sees luetic optic atrophies, but he does see traumatic ones, some of which are chiasmal. As none of these patients were operated on, definite diagnosis of arachnoiditis could not be made. Arachnoiditis is indicated when extraocular signs, such as bifrontal headache, are prominent features. Recently, over a 1½-year period, 10 cases were collected. It is only since 1929 that surgical intervention has shown the reality of arachnoiditis. About 10 percent of the 150 cases published are of traumatic origin. Very few of these traumatic cases go on to blindness.

Since 1934, Dr. Davidson said, he had followed a case of bilateral optic atrophy following head injury. A diagnosis of suprasellar cyst or tumor had been made, but he believed it to be opticochiasmatic arachnoiditis. Operation was refused, and central vision remained 20/20.

Dr. Joseph Igersheimer asked whether the postoperative course differed in those syphilitic patients with and without signs of tabes. He described the case of a patient with long-standing syphilis whose vision rapidly decreased. The only other symptom was headache. There was a binasal inferior quadrantanopsia and a right central scotoma. The neurologic, X-ray, and encephalographic examinations were not helpful diagnostically. Exploratory examination revealed an aneurysm on and medial to the right optic nerve. Two months postoperatively, the left visual field was almost normal and the vision was 20/40; the right eye was practically blind, and the disc atrophic. This case is of interest from the viewpoint of differential diagnosis and because of the binasal quadrantanopsia due to aneurysm.

Dr. Louis Hausman agreed with Dr. Davidson regarding the possibility of nonluetic adhesions about the chiasm. Adhesions were found on operation in several cases explored because of the clinical appearance of tumor. Luetic cases with and without signs of tabes followed the same postoperative course. It is not possible to say definitely how operation results in improvement. With adhesions about the optic nerve and foramina impairing circulation, their removal helps restore the blood supply.

#### MULTIPLE SCLEROSIS IN RELATION TO OPHTHALMOLOGY

DR. OTTO MARBURG discussed a series in which changes of the optic nerve occurred in 55 percent of cases. Clinically central scotoma was predominant, paracentral scotomas were frequent, ring scotomas rare. The scotomas started with a passing blindness or obscuration and disappeared completely in 98 percent of the cases. Persisting amaurosis was extremely rare. These scotomas are caused by a so-called retrobulbar neuritis, in



reality a multilocular retrobulbar demyelination with scant signs of inflammation. The sight depends on the integrity of the axons. The pallor of the papilla and the temporal pallor are caused by demyelination, whereas the axons may remain intact. Occasionally the axis cylinders are destroyed, causing permanent visual disturbances. The frequency of this retrobulbar multiple sclerosis among the retrobulbar neuritides is almost 60 to 70 percent. Retrobulbar neuritis after sinusitis is very rare (1 to 3 percent). The differentiation is occasionally possible; enlargement of the blind spot or ring scotomas in sinus neuritis; central scotomas, nystagmus, and the characteristic course in multiple sclerosis.

Papillostasis was occasionally observed (complicating hydrocephalus, circumscribed serous meningitis). Occasionally foci close to the eye produce edema. The stasis in multiple sclerosis is not equal throughout the papilla; spots of atrophy may accompany the stasis. The blood vessels are usually not enlarged despite the presence of hemorrhages.

The disturbances of the nerves of the ocular muscles are also frequent and to a great extent initial. The sixth is most frequently affected, whereas a complete third-nerve involvement has never been seen by Dr. Mårburg. Some branches of the third nerve on one or both sides are most frequently involved, and the disproportion between the complaint about diplopia and a scanty evidence of nerve palsy is surprising.

Pupillary changes are frequent, even an Argyll Robertson pupil may be present, and since the Wassermann and the gold sol tests are occasionally positive in multiple sclerosis, the differentiation from syphilis is difficult.

Brickner's oscillopsia is directly related to nystagmus. Its deterioration when walking may be explained by Uhtoff's

sign (deterioration of the eye signs in multiple sclerosis by any strain, walking in multiple sclerosis being a strain).

The most characteristic eye manifestations in multiple sclerosis are the sudden onset, the intermittent course, and the evidence that there is a multiple process, often proved by very slight signs in different parts of the body and discovered only by frequent examinations.

*Discussion.* Dr. Thomas H. Johnson stated that the average ophthalmologist does not see many cases of multiple sclerosis and those are naturally the ones in which first the eyes are involved. The eye manifestations are usually blurred vision due to retrobulbar neuritis and diplopia due to paresis of one or more extraocular muscles. Transitory remissions and recurrences are characteristic of multiple sclerosis. With succeeding recurrences there ensues pallor of the disc, which is temporal at first, but usually some vision is retained, even in the most advanced cases.

Dr. Johnson considers the pathology as being an infiltration in the myelin sheaths of the nerves as well as the higher levels. Impairment of function is due more to toxins than pressure of the plaques on the papillo-macular bundle, which, in general, is more resistant to pressure and more sensitive to toxins. With swelling of the nerve head there may be a question about papilledema, but central vision remains good in papilledema until secondary atrophy appears. In the early stages of a Foster-Kennedy syndrome there may be a central scotoma before the appearance of the optic atrophy (and the papilledema on the opposite side) and the diagnosis is difficult for the ophthalmologist.

Patients may live many years with multiple sclerosis. One case was seen which had been followed for 20 years, the first symptom having been temporary loss of vision.

An incipient myasthenia gravis may be hard to distinguish from an incipient multiple sclerosis associated with ocular-muscle weakness. The increase of symptoms as the day goes on and the Jolly tests for fatigability of the eye muscles help in distinguishing the two conditions. A case which appeared to Dr. Johnson to be a typical neuromyelitis optica was diagnosed multiple sclerosis by an eminent neurologist.

The diagnosis of multiple sclerosis is warranted in the presence of a central or paracentral scotoma, an ocular palsy, or both, and a nystagmus, a Babinski reflex, and absent abdominal reflexes.

Dr. Alfred Kestenbaum said he had seen cases of multiple sclerosis in which the disc was swollen and resembled papilledema. They differ in two respects: sudden severe visual loss with central scotoma, and tenderness of the eye on motion and pressure.

Nystagmus in multiple sclerosis is of three types: 1. An infrequent but pathognomonic pendular form resembling the usual fixation nystagmus but differing in its late onset, often accompanied by a sensation of rotation of the surroundings. 2. An almost pathognomonic symmetrical form in which a jerky nystagmus appears on rotation of the eye a constant distance in any direction from the mid-position. 3. An asymmetrical-gaze nystagmus which is brought out by ocular rotation of different degrees in different directions.

Dr. Marburg said that in cases of multiple sclerosis with ocular signs only, careful examination will usually bring out some previous symptoms, such as a complaint about recurrent rheumatism or fatigue on walking, which points to the correct diagnosis. Myasthenia gravis is recognized by the prostigmine test. The Foster-Kennedy syndrome is distinguished by the accompanying olfactory signs and its characteristic eye signs.

#### SOME EXPERIENCES WITH VASCULAR DISEASES OF THE EYE

DR. JOSEPH IGRSHEIMER discussed very different topics; however, all were concerned with vascular processes. He said that in prognosis and treatment of so-called embolism of the central artery more optimism is justified. Of course, many eyes are lost permanently, but others regain function after hope is lost. Examples were given of ophthalmoscopic changes as well as those found in other areas of the body, where spasms relaxed and function was improved or regained even after the obstruction had lasted a year or more.

In the glaucomatous state of venous obstruction a marked iritic hyperemia may cause great pain. Sometimes atropine is indicated and may prevent enucleation.

The pathogenesis of exudation into the retinal tissue was considered. Besides the lesion of the vessel wall the factors of the pressure within the vessel and that surrounding it—that is, the intraocular pressure—are significant. Some observations indicate that hypertensive, albuminuric, and diabetic retinopathy do not occur in glaucomatous eyes, or if already present disappear when glaucoma develops. Other findings are interesting from this viewpoint. For example, there is often a low intraocular pressure in cases of retinopathy or venous obstruction. Or, there is a marked difference between primary venous obstruction with secondary glaucoma and primary glaucoma with secondary venous obstruction. In the former case the usual retinal hemorrhages are absent.

Slides were presented showing exceptional branching of the central retinal artery in the optic nerve and pathology of the small vessels in the nerve.

A case of aneurysm of the internal carotid artery was reported. This was interesting, because: First, although the

aneurysm was located above the medial side of the right intracranial opticus, there was a *binasal* lower-quadrant hemianopia (a very rare occurrence in aneurysms of this region). Second, vision of both eyes was reduced to the perception of fingers at some distance. After exploratory operation, function of the right eye became worse and worse, whereas the left eye recovered entirely. The disc of the right eye showed pallor of the temporal side, that of the left showed no discoloration.

*Discussion.* Dr. Leo Buerger pointed out that *thromboangiitis obliterans* may affect blood vessels anywhere in the body. The pathology has been well studied and the lesions may resemble those produced by tuberculosis. Allergy may show a picture similar, pathologically, to Buerger's disease, the etiology of which is unknown. He suggested that ophthalmologists may contribute much to the knowledge of this disease if they study these lesions pathologically, trying to find them in the retinal vessels through ophthalmoscopic evidence.

Dr. Sigmund Agatston had also seen occlusion of the central retinal artery with recovery, and cited a case seen one hour after onset. The vision was 20/20 after six weeks. He believes that in venous thrombosis, in addition to the blocking of the vein there is also a secondary sclerosis of the artery. It is possible that in the cases wherein the intraocular pressure remains low, this is the result of reduced nutrition. High intraocular pressure is found in diabetes with rubeosis of the iris, and it remains high for long periods because of continued hemorrhage. In these cases eserine or pilocarpine is not indicated. When glaucoma is present the compression of the capillaries reduces the tendency to retinal exudation. Dr. Agatston had seen bad cases of glomerulonephritis which exhibited no fundus changes. He had never seen Buerger's disease in the eye, but

had seen an embolus in the retinal artery in a patient suffering from this condition who had had a previously normal fundus. Retinal arteriosclerosis should be divided into two groups: the rarely severe, progressive senile sclerosis; and the variety found in hypertension and nephritis, wherein occlusion of the arteries, by spasm, reduces the nutrition of the arterial wall, causing hyaline degeneration and fibrosis.

Dr. Martin Cohen said that he believed the improvement of vision in cases of occlusion might be due to canalization of the embolus. Most instances of chronic glomerulonephritis with hypertension show pathology in the eyegrounds.

Dr. Igersheimer concluded by pointing out that glomerulonephritis with high blood pressure and markedly elevated nonprotein nitrogen generally is associated with a retinopathy. He said that there is no doubt but that a so-called embolus can be recanalized with restoration of circulation. He wished to point out that the return of retinal function, after a long period of disability, shows the viability has not been destroyed during the time of dysfunction.

Leon H. Ehrlich,  
*Secretary.*

## CHICAGO OPHTHALMOLOGICAL SOCIETY

May 17, 1943

DR. LOUIS G. HOFFMAN, *president*

### CLINICAL MEETING

(Presented by the Department of Ophthalmology, Northwestern University Medical School)

### OLD INTERSTITIAL KERATITIS TREATED WITH BETA RADIATION

DR. HELEN HOLT presented S. J., a 12-year-old white girl, who was first seen in October, 1940. The right eye had been painful and extremely sensitive to light

for two weeks. On examination the cornea was steamy with flocculent infiltrates throughout the cornea. Vision was R.E. perception of light, L.E. 0.8. Blood Wassermann reaction was positive, and the child was placed on antisyphilitic therapy. Within two weeks blood vessels had invaded the corneal stroma of the right eye, and the left eye showed signs of involvement. Despite therapy the course of the disease was severe and prolonged. In December, vision was R.E. 20/65+1. L.E. 20/200. The photophobia was gone and the eyes were fairly white but the corneal changes were extensive. In March, 1943, visual acuity had changed little and it was decided to try beta radiation of the cornea in an attempt to clear some of the central clouding and some of the vessels. Three applications were made at weekly intervals, a 25-percent erythema dose to each quadrant of the eye. After three weeks the vision was R.E. 20/30, L.E. 20/70. There was much subjective improvement. The clouding had diminished in density and extent and many of the vessels had become "ghost" vessels. Further clearing was anticipated.

#### PROLONGED RETINAL ANGIOSPASM WITH RESULTING RETINAL DEGENERATION

DR. HELEN HOLT said that D. R., a white woman who had been presented before this Society in December, 1939 (*Amer. Jour. Ophth.*, 1939, v. 22, Nov., p. 1266), was suffering from retinal angiospasm associated with marked spasm of the peripheral vessels. Since that time the retinal spasm persisted in spite of all types of therapy. In July, 1941, in addition to very narrow retinal vessels and waxy-appearing discs, a fine mottling of the retinal pigment was noted in the extreme periphery. This degenerative change progressed toward the discs, and the macular areas became extremely mottled with radiating striae, as though the retina were edematous. The vitreous

frequently filled with dustlike opacities and floaters and then cleared. The central scotoma had increased in size and fused with peripheral changes so that the field of vision was greatly reduced. Visual acuity in the right eye was reduced to perception of large objects eccentrically; left eye 20/400 (Lebensohn near chart) and about 2/200. Repeated physical and neurologic examinations revealed no abnormalities. Spinal and blood Wassermann tests had always been negative. The degenerative changes were attributed to the prolonged malnutrition of the retinal tissues, due to retinal angiospasm.

#### CATARACTS ASSOCIATED WITH TARGET-CELL ANEMIA

DR. HELEN HOLT presented A. V., a 35-year-old woman of Sicilian parentage, had had anemia since childhood. During the past 10 years she had had muscle spasms but no convulsions. On examination there were no abnormal physical findings except lowered visual acuity. The red blood count was 2,340,000; hemoglobin 69; color index 1.0. Blood calcium level was 8.1 and a little later 6.9. X-ray studies of the bones showed generalized osteoporosis. The patient was placed on calcium therapy. Vision was R.E. 20/65, L.E. 20/40. There were fine granular opacities in radial arrangement in the cortex and clustered at the posterior pole, more marked in the right eye than the left; these showed an increase on each examination. In March, 1943, the vision was R.E. 20/200, L.E. 20/65. The granular opacities at the posterior pole had fused into a hammered metallic-appearing subcapsular film, and elsewhere in the cortex were much more dense. A complete blood study resulted in a diagnosis of erythroblastic anemia (Cooley's) from the finding of target cells, microcytosis, hypochromia, and increased resistance of the red cells to hypotonic solution. The calcium deficiency

cy with the associated lens changes is now attributed to this type of anemia.

#### COMPLETE COLOR BLINDNESS

DR. HELEN HOLT presented A. W., a 27-year-old woman, who had had poor vision since childhood, extreme sensitivity to sunlight, and better vision in twilight. She had always been totally color blind and had distinguished differences in colors and shades by variation in the gray intensity. Vision was 2/200, 8-point print at 4 inches, and improvement only to 20/200 with a moderate compound myopic astigmatic correction. An oscillating nystagmus was present. The fundi were normal. Visual fields plotted on the tangent screen showed a symmetrical cecocentral scotoma for the 1-mm. target. Colors could not be identified in the pseudo-isochromatic plates or yarn tests. A brother was similarly affected, but the condition was not present in any other members of the family so far as the patient knew.

#### PLASTIC OPERATION OF THE LIDS AFTER RADIATION THERAPY FOR BASAL-CELL CARCINOMA

DR. HELEN HOLT presented E. S., a 72-year-old woman, who had been shown before this Society in January, 1941. The outer angle of the eye, part of the temporal region, and one half of the lower lid was destroyed by a basal-cell carcinoma which had recurred four years previously, after having been treated with radium. Following treatment with a total of 1,859r with radium the tumor became inactive. In 1942, a modified Wheeler operation was performed in an attempt to rebuild the lid; a second skin graft was performed a few months later. At this time the carcinoma was inactive. There was still a defect of the outer third of the lid margin with exposure of the conjunc-

tiva, and an additional plastic operation will have to be performed. Vision in this eye remained 20/25, and no lens changes had developed following the use of intensive radiation therapy.

#### SCIENTIFIC PROGRAM

##### VISUAL TESTING IN INDUSTRY WITH DEMONSTRATION OF THE ORTHO-RATER

DR. HEDWIG KUHN gave this demonstration.

##### OPTIC-NERVE ATROPHY IN MALIGNANT NASOPHARYNGEAL TUMORS

DR. MARTHA RUBIN FOLK presented a paper on this subject which was published in this Journal (April, 1944).

##### THE SURGICAL TREATMENT OF THE ORBITAL MANIFESTATIONS OF HYPERTHYROIDISM

DR. PAUL C. BUCY said that the exophthalmos so commonly associated with hyperthyroidism usually subsides with the decline of the other symptoms. Rarely, however, it is noted a few days or weeks after the thyroidectomy that the exophthalmos is growing progressively worse. The bulbs become so prominent that complete closure of the lids becomes impossible. The conjunctiva becomes edematous and then injected. The cornea and conjunctiva become dry, then ulcerated and finally develop infection. If the process has not been arrested before this, a panophthalmitis, with loss of the eye, or meningitis, brain abscess, and death is the usual termination.

The treatment of these cases of malignant exophthalmos is not simple. Plastic operations on the eyelids, sympathectomy, and decompression by means of the Krönlein operation, are usually wholly inadequate.

The first indication is careful cleansing of the eyes and the application of trans-

parent moisture-tight shields to prevent drying of the cornea and conjunctiva, to prevent injection, and to encourage epithelization of ulcerated areas. Next, the orbits should be adequately decompressed so as to permit the lids to close and protect the eyes. This is best accomplished by Naffziger's operation. This procedure was devised by him in the early 1930's, and Dr. Bucy said he performed his first operation of this type a few months after learning of Naffziger's first successful result. A frontal osteoplastic craniotomy is made. The frontal lobe is elevated above the roof of the orbit extradurally. The roof and postero-lateral wall of the orbit are then removed, and, if necessary, the optic foramen can be unroofed. The orbital capsule is then incised widely. Only one side should be operated on at a time. The second operation may be carried out after an interval of a few days to a few weeks, depending on the condition of the patient. Careful toilet of the eyes and the use of moisture-tight shields should be continued after the operation.

The details of the original case and of the most recent cases of this type in which operations had been performed were presented.

*Discussion.* Dr. Sanford Gifford mentioned a case similar to those described by Dr. Bucy. A neurologic surgeon in another city had refused to perform the Naffziger operation on this patient and, when he came to Chicago, Dr. Cleveland did a bilateral decompression in one sitting, which was well tolerated. The patient had marked chemosis on one side, and, in addition, a condition not mentioned by Dr. Bucy, paralysis of the ocular muscles. The involvement of the cornea is probably due to a paralysis of the superior rectus muscles which prevents the eyes from turning up under the upper lids. In this case it was necessary to per-

form an intermarginal adhesion on one side. This is the procedure described by Wheeler, in which a small area of the lid margin is denuded in two places, then held together with sutures. It can be done following decompression.

This is a vicious circle—the decompression is done because of the chemosis, and the second operation is necessary to get rid of the chemosis which persists. If the second operation were done as part of the primary procedure it would probably be more satisfactory. Instead of suturing the lids together—the neurologic surgeons always do this and the sutures always come out in two or three days—if an intermarginal adhesion were done and allowed to remain in place for two months the result would be good. One need not worry about conjunctival infection; the chemosis subsides rather rapidly when the eyes are closed.

Dr. Michael Goldenburg recalled a case reported in 1933 before this Society (Amer. Jour. Ophth., 1934). A thyroidectomy had been performed by a competent surgeon several months previously. Because of edema and proptosis, a cervical ganglionectomy was done with some improvement, and repeated without much benefit when the exophthalmos recurred. When the patient was seen at the Illinois Eye and Ear Infirmary, no improvement in the condition followed such procedures as canthotomy, suturing the lids, and so forth, and it was decided to explore the orbits. Under general anesthesia the right orbit was entered through a deep fascia incision. When the deep fascia was retracted the fat rolled out as if under pressure. Tissues were removed for study and a drainage tube was inserted. Drainage was also instituted in the other eye.

Active dehydration by proctoclysis was accomplished by means of 500 c.c. of a 25-percent solution of magnesium sulfate,

later increased to 1,000 c.c., alternating with a 25-percent solution of glucose injected intravenously. Improvement was noted in a few days and at the end of about two weeks the patient was able to close the eyelids. The orbit from which no fat was removed and on which only the decompression was performed seemed to do better than the other. The patient was discharged with 10/200 vision without glasses. He had been seen as recently as two years ago.

In studying the removed tissue it was found that the fat consisted of lobules divided by dense connective tissue. It was considered to be a low-grade infection with round-cell infiltration with many polymorphonuclear cells and red cells.

There is distinct limitation of motion of the eyeball in the orbit when the exophthalmos is permanent, and this may be due to the connective-tissue formation. Cases are cited in the English literature of edema persisting even after enucleation of the eye. This is not edema in the usual sense; it is a more solid edema, even myxedema, although there is a difference of opinion on that. Lahey considers this type of edema a myxedema. If it were ordinary edema it should pass off rapidly, but even the subconjunctival tissue is changed into dense connective tissue. If the eyeball can be replaced by palpation prior to operation, it will return to normal position, but if it cannot be replaced there has been connective-tissue formation which will not improve.

Dr. Peter C. Kronfeld said that Reichling and Marx (in Graefe's Arch., 1940, v. 141, 374) expressed the view that strangulation of the circumcorneal portion of the bulbar conjunctiva by the tight lids is an important factor in the pathogenesis of the corneal complications of malignant exophthalmos. In order to relieve this strangulation the two authors

recommended wedge-shaped excisions of the conjunctiva, including the indurated subconjunctival tissue. They report five cases in which that procedure alone was sufficient to make the eyeball recede and to bring the disease to a successful conclusion.

Dr. Bucy's statement that the orbital disease as such may not be so progressive as it seems, but that a vicious circle may be set up in the orbit, deserves to be stressed. It is gratifying to hear that opening the optic canal is not essential for the success of the Naffziger operation. Of the two dangers, loss of the eye through perforation of the cornea or loss of vision by optic atrophy, the former occurs more often than the latter. While the relationship between hyperthyroidism and the orbital changes discussed here is not completely understood, it is definitely not that of cause and effect; in other words, the orbital changes are not the direct effect of the hyperthyroidism. As Moncreiff has remarked, these eye changes may occur after thyroidectomy has been performed when the patient is in a state of myxedema. The orbital changes are probably directly related to a state of partial hyperpituitarism; that is, to the so-called central factor in toxic goiter.

Dr. Paul C. Bucy, in closing, expressed his appreciation of the interesting discussion, particularly the point brought out by Dr. Gifford about limitation of the movement of the bulb, which is one of the characteristics of the disease and which is always present. The description of the pathology given by Dr. Goldenburg, and his original and successful treatment of his case, were also interesting. Dr. Kronfeld's discussion of the relationship or lack of relationship of the pathology to the hyperthyroidism is thought provoking as well as interesting.

Robert Von der Heydt.



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## ACADEMY MEETING OF 1944

Chicago was again host to the American Academy of Ophthalmology and Otolaryngology in the second week of October. A large group of physicians and their wives attended. The Palmer House extended every facility to the Academy as it always does. No hotel can take perfect care of as many as attend this convention and there are certain to be some inconveniences connected with the almost simultaneous arrival of 2,000 guests, such as waiting in line for rooms. Then, too, elevator service is occasionally unsatisfactory, but here again the Academy puts

an enormous burden on what are normally adequate facilities by having so many courses start and finish at the same time, so that there is no distribution of the demand for elevators. Possibly start and conclusion of courses could be staggered a little, so as to simplify this somewhat. Considering the war time the food and service were good. These, of course, are secondary matters, but the success or failure of a convention often hinges on them. Few will regret the choice of the Palmer House for the next year's gathering. As a matter of fact, it is almost Hobson's choice for there are only a few hotels that

can house the Academy. New York hotels are not interested now, since they are crowded beyond belief with individual transients, and the Pacific Coast is too far away for war-time travel.

All sessions were well attended. The ever-increasing popularity of the motion-picture sections was evidenced by their removal to the Grand Ball Room where they displaced the scientific sections, which succeeded them to the Red Lacquer Room. The motion pictures were excellent. Their use is surely a most satisfactory method of teaching.

The joint session on Monday, at which the question of head pain was considered, was highlighted by Dr. Bayard T. Horton's excellently illustrated presentation of histamine headaches. Their terrible severity, usually unilateral nature, rapid relief by adrenalin, and cure or at least long-lasting relief by histamine desensitization were admirably depicted. At the ophthalmic section, many excellent papers were read. The ever clinically minded were particularly attentive to the Wilmer report by Drs. William F. Hughes, Jr., and William C. Owens on cataract extraction. Best results were obtained when two McLean sutures were used and a round pupil retained after an intracapsular extraction.

Another presentation of great interest was that of Dr. Pischel on the surgery of retinal detachment. His results in uncomplicated cases are almost incredibly good. This was developed in his instruction course, not in the scientific discussion, which was concerned particularly with scleral resection in cases of retinal shortening from scars and the like, and is successful in less than 30 percent of the cases, but well worth trying in otherwise hopeless cases.

Another interesting paper was on choice of operation in eyes with primary glaucoma and cataracts presented by Dr.

Jack Guyton. He concluded that if the glaucoma could not be controlled by miotics and was noncongestive, some fistula-producing operation should be done; if, however, the glaucoma could be controlled or if chronic congestive, a combined cataract extraction should be done, which often is all that is necessary. Finally, that making the section through the bleb was as good as making it anterior to it.

Entertainment was somewhat restrained as befitted a war-time program. An informal dinner was substituted for the usual banquet. Excellent talks were made by Lt. Col. James N. Greear, Jr., on "The rehabilitation of the war blinded" and by Dr. Raymond B. Allen on "Post-war medical education," both vital subjects to everyone either directly or indirectly. The beautiful violin solos by Mrs. Anderson Hilding must surely be mentioned as a major factor in the pleasure of the evening.

On the preceding night alumni banquets were followed by beer and dancing in the Grand Ball Room and by floor shows from the Empire Room. This form of entertainment seems as satisfactory as any thus far devised for an early get-together of the members.

An attempt was made to improve the business meeting by introducing the Jackson Memorial Lecture and inviting the neophytes especially to be present. Dr. William H. Crisp delivered a truly classical paper on the development of refraction with Dr. Jackson's special contribution to it to an appreciative audience of two or three times the usual size; unfortunately, very few of the new members put in an appearance. Apparently this is not the way to attract them. Dr. Crisp's paper will appear in this Journal.

New officers are Dr. Gordon B. New, president; Dr. Alan C. Woods, president-elect; Dr. Edmund B. Spaeth, first vice-president; Dr. William H. Johnston, sec-

and vice-president; and Major Brittain F. Payne, third vice-president, and Dr. Charles D. Blassingame, member of the Council.  
Lawrence T. Post.

### BRITISH DISCUSSION OF SOCIALIZED MEDICINE

For some months past the columns of the British Medical Journal, the organ of the British Medical Association, have carried an abundance of discussion of the "White Paper," the document which offered for open debate an outline of the British Government's proposals for a general system of socialized medicine.

The views expressed are many. More frequently they are unfavorable to, or at least severely critical of, the British Government's proposals. But, in leading articles, reports of speeches, and, above all, in that open correspondence which is so striking a feature of British journalism, all shades of opinion are represented.

In the columns of a periodical officially representing the British Medical Association it is refreshing to find a number of letters expressing frank and occasionally rather bitter criticism of that medical organization. The Association, through its Council, while condemning the Government scheme in certain principles and details, has shown a disposition to offer constructive criticism for improvement in the proposals. In this connection it is important to remember that the British Government has announced its firm policy to adopt a general scheme of medical socialization, but issued the White Paper as an avowed basis for free public and professional discussion before the actual introduction of a parliamentary bill.

Very blunt is the attitude of the gentleman who speaks of the "apostasy of the B.M.A.," but a speaker who has leanings in the other direction finds it necessary to

suggest that many of the letters "contain much individual prejudice, and are written as though their opinions and statements were self-evident facts."

Dr. H. Guy Dain, Chairman of Council of the B.M.A., speaking before the profession at Bristol, calls attention to the wide contrasts between those physicians who would take no part whatever in a government service, however organized, and those of the other extreme who believe that the best service would be by whole-time salaried officers; and between those who argue that the state service should be for everybody in the country, "irrespective of means, age, sex, or occupation," and those who believe in limitation to a certain income level. Dain points out that private practice is beginning to reappear even in Russia, and that in Norway, notwithstanding a system of state hospitals, voluntary hospitals have entered the field. Whatever arrangement is made, Dain suggests, it must provide for the freedom of the patient to go where he desires for his doctoring and to pay for it if he wishes to do so.

We find one writer stating that the general British public has welcomed the scheme; and another declaring that one hundred percent of his office patients have voted against it.

One correspondent writes at some length to draw a parallel between the attitude taken by the British Medical Association in 1911, when Mr. Lloyd George introduced his National Insurance Bill, and the situation today. It is suggested that the British Medical Association then fought what at first appeared to be a losing battle but in the end worked out not so badly for the profession. This writer quotes a British gibe to the effect that "The National Insurance Act gave the doctors their motor cars." In 1911, while the National Insurance Bill was being fought in Parliament, the British

Medical Association "obtained the signatures of twenty-seven thousand doctors to a pledge that they would not accept service under the Bill except on terms in accordance with the Association's policy, and that they would not enter into any contract except through a local medical committee representative of the local profession." Today, says the same writer, the British profession has the advantage of considering a preliminary scheme instead of fighting a bill already introduced into Parliament.

Surgeon Vice-Admiral Sheldon Dudley, Medical Director-General of the Navy, delivering the Harveian Lecture before the Harveian Society of London, pointed out that the oldest and most comprehensive medical services were those of the Navy and Army. Speaking as to the possible effect of a set salary upon the quality of the physician's work, Admiral Dudley said that in the British Navy there were very few medical officers who did as little work as possible, and he argued that "on the whole, self-respect, the desire to do well in the eyes of the herd, a natural sympathy with sick people, and a praiseworthy desire for promotion would outweigh the alleged stultifying effect of a fixed salary." He suggested the experience of the Navy showed that "a patient-doctor relationship of the best type was possible on a salaried basis of remuneration and without free choice."

British municipal hospitals have come in for a good deal of abuse as contrasted with the voluntary hospitals. Yet the accommodations provided in the voluntary hospitals are far from adequate, as demonstrated by the fact that there is usually a long waiting list of applicants for admission.

One of the most interesting products of the British controversy as to the Government's proposals takes the form of a vote by medical students upon a number of

questions submitted to them by the British Medical Students' Association. About one fourth of the total number of students replied. Forty-nine percent of them thought that the quality of the country's medical service would be enhanced by the proposed National Health Service, thirty-six percent thought it would suffer, fourteen percent "did not know." Seventy-two percent thought that complete medical services, including hospital and specialized services, ought to be available to everyone free of charge. Eighty-nine percent approved of the principle of health centers. Fifty-three favored payment by a small basic salary plus capitation fees. Sixty-three percent made a statement that it would not be possible for them to set up in practice without incurring a debt. Fifty-one percent reacted on the whole favorably to the Government's White Paper, forty percent unfavorably, and seven percent "did not know." Incidentally it may be mentioned that of those whose fathers were physicians fifty-two percent reacted unfavorably to the document and only thirty-eight percent were definitely favorable.

From medical students a similar vote would rather likely be obtained in the United States, since those who have not yet attained the position of special privilege associated with established practice are still preoccupied with the problem of buttering their daily bread. A British physician "under forty" suggests that the White Paper offers the young doctor two important advantages which should not be forgotten in discussing the future health services; namely, the opportunity to undertake general practice unburdened by financial considerations, and the existence of many more openings for the doctor who wishes to specialize.

What part does ophthalmology play in this general discussion of the British Government's proposals? Plans for an oph-

thalmic service have brought up the question whether refraction shall be carried on entirely by ophthalmic physicians or shall enlist the coöperation of sight-testing opticians. One writer points out that against seven thousand opticians at present officially recognized as qualified to undertake National Health Insurance work, there are throughout the country only about one thousand ophthalmic medical practitioners, a part of whose time is taken up with other eye work. These figures were the basis of a recent recommendation by the Ophthalmic Group Committee's draft scheme for a National Eye Service, which suggested that it would be necessary to call in the aid of optician refractionists who would work under the supervision of medically qualified specialists. The suggestion that in a few years time a sufficient number of physicians could be trained to do the refraction work is derided by the correspondent on the ground that "men are not going to take the six years medical course, then specialize in ophthalmology, and spend the rest of their lives doing refractions." The correspondent would establish eye clinics each "staffed by a medical eye specialist, who will have under him two or more optician refractionists," with sometimes the help of a nurse, clerical assistants, and possibly an orthoptist. The ophthalmic specialist would do only "difficult refractions or those requiring a cycloplegic." The writer assumes that in the course of years most sight-testing opticians will either "decide to go over to the dispensing side of the business or be absorbed as refractionists in the eye clinics." Some readers will admire (!) the faith of this correspondent in the ability of the subordinate refractionist to determine which refractions are difficult and which will require the use of a cycloplegic.

If a system of socialized medicine is adopted in the United States, very thorny will be this problem of who shall do re-

fraction in the public clinics or wherever it may be done out of the funds provided under the law.

W. H. Crisp.

## BOOK NOTICES

I WANTED TO SEE. By Borghild Dahl, with a Foreword by William L. Benedict, M.D. New York, The Macmillan Co., 1944. Price \$2.00.

Some two years ago Dartmouth College published a book, "Motivation and visual factors," based upon an intensive study of a large group of college students. The conclusion of the authors, in brief, is that visual handicaps as such can be considered only in relation to the entire personality, specifically to the motivating drives of the individual. The motivation seems to be the dominant factor in any successful or unsuccessful adjustment to the presence of visual anomalies.

No stronger corroboration of the soundness of this conclusion can be found anywhere than in the personal narrative of Miss Dahl, in her volume, "I wanted to see." Here is a woman who from her earliest childhood was totally blind in one eye, had vision of only 4/60 in the other eye, and yet by sheer will and tenacity of purpose managed to get almost everything she strove for, and she aimed high. She would have done wonderfully if she had managed merely to get through grammar school. But Miss Dahl completed a regular high school course, a full college and university course, with the Bachelor and Master of Arts degrees, became a successful high school teacher, and later a college professor. She also managed to win a fellowship from the American Scandinavian Foundation, which, acclaiming her as a distinguished student in sociology, sent her for a year's study to Norway. And this is not all. We could go on discoursing on her extracurricular accomplishments; for example, being chosen

to give book reviews for clubs, for the Book Review Guild of America, to talk over the radio, and other like activities.

It is a fascinating narrative, heart warming and inspiring. One is thrilled by the unfolding of the life story of a woman, who, blind for all practical purposes from earliest childhood, refused to be "different" from the normally seeing. Her indomitable will to succeed, aided by whatever skillful medical science could do, conquered everything.

For the eye physician this book has a special message. He is often called upon to advise and pass upon the schooling or career of a youngster with defective eyes. Here the doctor is faced with a grave responsibility. It were well that before recommending limitations on a child's schooling and career the doctor study the child as a personality. His whole life may depend upon the doctor's judgment.

Miss Dahl's case may be unusual, an extreme instance, but it does show most convincingly that a child with a dominating motive to achieve and to learn will go further in life, despite visual defects, than a child who is unambitious and listless, though he possess perfect eyes.

In a sense, the book deals with a "ponderous" subject but the style is light and humorous, tinged with pathos here and there. It is highly recommended to lay and professional readers alike.

Joseph I. Pascal.

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**LIGHT, VISION AND SEEING.** By Matthew Luckiesh, D.Sc., D.E. Cloth-bound, 323 pages, 16 plates, and 83 text figures. New York, D. Von Nostrand, Inc., 1944. Price not given.

The subtitle of this work is "A simplified presentation of their relationships and their importance in human efficiency and welfare." In this book the author points out in the first chapter the fact that mankind has become enslaved by

near vision. Hereditary adaptation has been quite unable to keep pace with the extraordinary rapidity of the change from outdoor seeing to day-long indoor tasks. The author attributes eye defectiveness primarily to this fact and makes the important point that though eyesight specialists have made "enormous strides in eye-care, eye-treatment, and eye surgery. . . . Their primary interest is in vision, not in seeing." He further states that "the eyesight specialist is paid for caring for eyes and for prescribing eyeglasses, rarely is he paid to follow eyes into the world of use and abuse." He believes that far too much time has been spent in repairing visual defects and much too little in prophylaxis. He does not, however, carry this thesis further than to state that it is obviously impossible to induce mankind to revert to outdoor life and offers only the improvement of lighting in its broadest sense as a preventive for the ocular difficulties inherent in our manner of life. He gives statistics indicating the greatly increasing deterioration in vision as life progresses and also cites statistics to show that the vision of outdoor man is much better than that of the indoor man. Obviously the thesis of the book is in the subtitle; that is, the contribution that can be made to adequate seeing by adequate lighting. This is the field in which the author has so ably delved for many years and in the promotion of which he has spent his life and made widest researches.

The book is convincing and easy reading for anyone-interested in the subject. It has not the elements which would ever make it a best seller, because, though simplified, it still must be classed in the group of serious literature and could scarcely have great popular consumption. There is a considerable list of references and an adequate index. The illustrations and charts are very well done and serve their purpose excellently.

Lawrence T. Post.

# ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

## CLASSIFICATION

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| 1. General methods of diagnosis                        | 10. Retina and vitreous                                |
| 2. Therapeutics and operations                         | 11. Optic nerve and toxic amblyopias                   |
| 3. Physiologic optics, refraction, and color vision    | 12. Visual tracts and centers                          |
| 4. Ocular movements                                    | 13. Eyeball and orbit                                  |
| 5. Conjunctiva   | 14. Eyelids and lacrimal apparatus                     |
| 6. Cornea and sclera                                   | 15. Tumors   |
| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries   |
| 8. Glaucoma and ocular tension                         | 17. Systemic diseases and parasites                    |
| 9. Crystalline lens                                    | 18. Hygiene, sociology, education, and history         |
|  | 19. Anatomy, embryology, and comparative ophthalmology |

### 5

#### CONJUNCTIVA

Canamares Mareno, S. *Sporothricosis conjunctivitis*. Arch. de la Soc. Oft. Hisp.-Amer., 1943, v. 3, Sept.-Oct., pp. 222-224.

Four cases are reported of diffuse infiltration of the bulbar conjunctiva without ulceration. Preauricular adenopathy was present in all the cases. The diagnosis was confirmed in two cases by finding of the sporothrix in aspirated pus from the preauricular gland. All cleared up under treatment with potassium iodide.

J. Wesley McKinney.

Curry, J. J., and Lowell, F. C. *Epidemic keratoconjunctivitis*. New England Jour. Med., 1944, v. 231, July 6, pp. 11-13.

A male metal worker, 27 years of age, one week before admission to the hospital, had had chilly sensations followed by fever which subsided by evening and recurred in the morning. At that time he noticed a swelling about

his eyes which became quite painful. Lethargy was pronounced and several evanescent zones of erythema scattered over the face and forearm were visible. The lymph nodes in the region of the ears in the cervical and occipital regions and the right axilla were enlarged and tender. Frontal and occipital headaches were intense. The conjunctiva was diffusely injected and photophobia marked. The cornea was normal. The patient stated that he had had a mild respiratory infection that had cleared 14 days before the onset of the present illness. He stated also that he had had foreign bodies in his eyes on several occasions. The patient improved on the fifth day and a few days later left the hospital. The writer says that the diagnosis of the disease is difficult when keratitis is absent (as it is in 47 percent of the cases) and when the disease is sporadic, unless the virus is isolated or a rise and fall in antibody titer is demonstrated. In the present case serologic studies during convalescence showed development of antibody against the virus of epidemic



keratoconjunctivitis. (References, one figure.) M. Lombardo.

Freeman, J. D. J. A granulation tumor of the conjunctiva. *Brit. Jour. Ophth.*, 1944, v. 28, June, pp. 277-278.

The patient's complaint was of constant discomfort of the left eye, with a feeling of heaviness in the upper lid. The lid tended to droop and there was watering of the eye. The symptoms dated from 1933 or 1934. Discomfort had gradually become more marked. The right eye had never been affected. Examination showed the conjunctiva over the tarsal plate of the left upper lid to be covered with multiple pinkish granulomatous nodules, glistening and soft in consistency. There was no discharge. Examination of the cornea with the loupe and the slitlamp showed no signs of pannus. The bulbar conjunctiva and the lower fornix appeared healthy. The pre-auricular gland was not enlarged. The right eye was unaffected.

Treatment with copper sulphate, magnesium-sulphate solution, and albucid, as well as injections of old tuberculin, gave no improvement. Tarsectomy gave entire relief and the patient made an uneventful recovery. Microscopic examination showed a typical granulation tumor without any evidence of neoplasm. The possible causes for this condition are considered and discussed. Edna M. Reynolds.

Fried, J. J., and Goldzieher, M. A. The endocrine treatment of keratoconjunctivitis sicca. *Amer. Jour. Ophth.*, 1944, v. 27, Sept., pp. 1003-1006. (References.)

Gifford, S. R., and Day, A. A. *Leptotrichosis conjunctivae*. *Arch. of Ophth.*, 1944, v. 31, May, pp. 423-426.

This study includes only those cases in which the leptothrix or a thread

mold presumed to be leptothrix was found in section or culture. Observation of leptothrix in sections was first made by Verhoeff in 1913. A special staining technique was necessary, and the organism was found only when a characteristic area of focal necrosis was excised and fixed in Zenker's fluid.

The authors conclude that examination of properly fixed and stained material in sections offers greater likelihood of positive identification of the leptothrix than the use of cultures. The value of cultures in addition to sections, however, should not be minimized, as exact identification of the organism in a greater number of cases is desirable. (References, 1 photomicrograph, 1 table.)

R. W. Danielson.

Heimans, M. Keratoconjunctivitis control measures for industry. *Industrial Bulletin (New York)*, v. 22, Aug., p. 328.

The author suggests control measures as follows: educating medical personnel as to characteristics of the disease, proper care of hands and instruments used in examining patients, isolation of cases, education of those affected in how to prevent spread of the disease, and adequate sterilization of goggles. F. M. Crage.

Magnus, J. A. Unilateral follicular conjunctivitis due to molluscum contagiosum. *Brit. Jour. Ophth.*, 1944, v. 28, May, pp. 245-248.

After three months of treatment along the usual lines for acute conjunctivitis and superficial keratitis, developing after influenza, several small umbilicated tumors were found on the upper and lower lids, encroaching upon the lid margins. The tumors were removed for biopsy and those at the lid margin were destroyed by

electric cautery. The conjunctivitis cleared up entirely within a month after removal of the tumors. The diagnosis of molluscum contagiosum was confirmed by histologic examination. (5 photomicrographs.)

Edna M. Reynolds.

Marin Amat, M. Contribution to study of the treatment of vernal conjunctivitis. Arch. de la Soc. Oft. Hisp.-Amer., 1943, v. 3, Aug.-Sept., pp. 185-189.

Two cases of vernal conjunctivitis with large tarsal vegetations are reported. One was treated with X-ray and the other was operated upon by the Blascovics procedure. Neither case was permanently benefited.

J. Wesley McKinney.

Mata López, Pedro. Conjunctivitis produced by the staphylococcus. Arch. de la Soc. Oft. Hisp.-Amer., 1943, Sept.-Oct., v. 3, pp. 201-209.

Staphylococcus conjunctivitis is much more common than is generally believed. It may be associated with staphylococcal infections elsewhere or may occur as a primary infection. The diagnosis is made by smears and cultures from conjunctiva, together with tests for hypersensitivity to the organism. The most efficacious treatment was found to be local use of sulfonamides.

J. Wesley McKinney.

Mata López, Pedro. Contributions to the study of corneoconjunctival calcareous dystrophy, with case report. Arch. de la Soc. Oft. Hisp.-Amer., 1943, v. 3, Aug.-Sept., pp. 210-217. (See Section 6, Cornea and sclera.)

Moreu, Angel. Vasomotor reactions in the pathogenesis and treatment of conjunctivitis. Arch. de la Soc. Oft. Hisp.-Amer., 1943, v. 3, Sept.-Oct., pp. 194-200.

In vagotonic individuals the conjunctival reaction to various irritants such as excessive cold, heat, ocular fatigue, and other physical or chemical agents is likely to be more marked and prolonged than the physiologic reaction of normal individuals to equal irritation. The conjunctiva becomes injected, with possibly some lacrimation and mucous secretion and reduction in the lysozyme content of the tears. In time the conjunctiva becomes truly hypertrophied and is fertile soil for growth of bacteria. The problem then is to control the vasomotor reactions of the conjunctiva, thus relieving the incident symptoms and preventing the repeated infections which so often occur. In the vasomotor phase this end is accomplished by administration of "bellafoline" to diminish the preponderance of vagus and "ephedrine" to secure excitation of sympathetic. At the same time conjunctival and nasal instillations of ephedrine and adrenalin are made several times daily. No conjunctival antiseptic should be used. If a true conjunctivitis develops, the usual silver nitrate and antiseptics are used. As soon as the infection is eliminated, zinc sulphate is substituted for its astringent effect until the conjunctiva has returned to its original state.

J. Wesley McKinney.

Pérez Llorca, J., and Jiménez Almenara, J. Reaction of agglutination to B proteus, and intradermal reaction with an extract of the same organism. Its lack of value in trachoma. Arch. de la Soc. Oft. Hisp.-Amer., 1943, v. 3, Sept.-Oct., pp. 285-288.

The Weil-Félix reaction was positive in only one of 160 cases of trachoma and in none of fifty controls. The intradermal reaction was negative in twenty trachomatous and twenty nor-

mal individuals. The conclusion is that neither the Weil-Félix nor the intradermal reaction is of value in the diagnosis of trachoma.

J. Wesley McKinney.

Reid, R. D. Meningococcic conjunctivitis. *Jour. Amer. Med. Assoc.*, 1944, v. 124, March 11, p. 703.

The author points out that meningococcus carriers are not a rarity and that meningococcic conjunctivitis may be more frequent than commonly thought. In any acute conjunctivitis in which gram-negative diplococci are found, serologic and cultural tests are necessary to distinguish between the gonococcus and the meningococcus, thus avoiding searches for sources of infection if the latter organism is at fault. A case history of meningococcic conjunctivitis in a two-year-old child with complete recovery on sulfathiazole therapy is reported.

Robert N. Shaffer.

Saracibar, J. M. On the diagnosis of gonococcic conjunctivitis. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1943, v. 3, Sept.-Oct., pp. 218-221.

Three cases of purulent conjunctivitis are cited from which a gram-negative diplococcus was isolated. Upon culture two of these cases proved to be of micrococcus-catarrhalis infection and the third a gonococcus infection. The conclusion drawn is that differential cultures should be made in all cases of suspected gonococcic conjunctivitis. J. Wesley McKinney.

## 6

### CORNEA AND SCLERA

Braley, A. E., and Sanders, M. Treatment of epidemic keratoconjunctivitis. *Jour. Amer. Med. Assoc.*, 1943,

v. 121, March 27, p. 999. (See Section 5, Conjunctiva.)

Calkins, H. E., and Bond, G. C. Adaptation of virus of epidemic keratoconjunctivitis to development in extra-embryonic fluids of chick embryo. *Proc. Soc. Exper. Biol. and Med.*, 1944, v. 56, May, p. 46. (See Section 5, Conjunctiva.)

Curry, J. J., and Lowell, F. C. Epidemic keratoconjunctivitis. *New England Jour. Med.*, 1944, v. 231, July 6, pp. 11-13. (See Section 5, Conjunctiva.)

Fried, J. J., and Goldzieher, M. A. The endocrine treatment of keratoconjunctivitis sicca. *Amer. Jour. Ophth.*, 1944, v. 27, Sept., pp. 1003-1006. (References.)

Heimans, M. Keratoconjunctivitis control measures for industry. *Industrial Bull. (New York)*, 1943, v. 22, Aug., p. 328. (See Section 5, Conjunctiva.)

Mata López, Pedro. Contributions to the study of corneoconjunctival calcareous dystrophy, with case report. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1943, v. 3, Aug.-Sept., pp. 210-217.

The case reported is one of calcareous degeneration of the cornea and of the tarsal conjunctiva of each eye. Both corneas showed punctate deposits of calcium in the superficial stroma, separated by clear areas. The deposits involved the outer cornea except the extreme periphery. The cornea presented a whitish appearance which was less dense in the center. There were subepithelial islands of calcium deposits on the tarsal conjunctiva. Blood-calcium and phosphorus were within normal limits and no glandular

abnormality could be demonstrated. The author discusses the relationship between the parathyroids and vitamin D and the metabolism of calcium and phosphorus. Despite the normal blood phosphorus and calcium the author gave a diet low in calcium, plus ammonium chloride and dionin locally, with the idea that calcium might be absorbed from the corneconjunctival lesions. A 30-percent clearing was obtained. Vision improved from perception of large objects at 2 to 3 meters to 1/10 in the right eye, and from 1/4 to almost 2/3 in the left eye.

J. Wesley McKinney.

7

UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Neogy, B. P. Tonic pupils and absent tendon reflexes (Adie's syndrome). *Calcutta Med. Jour.*, 1943, v. 40, July, p. 253.

A 29-year-old woman complained of pain which had continued in the right side of her neck since 1934. The Wassermann reaction was negative. The right eye was normal to light and convergence reaction. The left pupil was widely dilated and it dilated still more while staying for twenty minutes in a dark room. On exposure to light the pupil first contracted slowly then briskly. Maximal convergence took place after one minute, and the pupil took 7½ minutes to regain its normal size. Knee jerks and ankle jerks were absent on both sides. X-ray examination of the skull revealed that the clinoid processes formed almost a roof over the pituitary fossa. Although the latter condition may sometimes be found among normal persons, the author considers it worthy of further investigation.

R. Grunfeld.

Oroz Zabaleta, H. Recurrent allergic uveitis with hypopyon. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1943, v. 3, Sept.-Oct., pp. 170-175.

A case is reported wherein were recorded repeated attacks of uveitis with hypopyon, associated with arthritis and cutaneous ulcers. All examinations were negative except for a marked allergy to the staphylococcus. Both eyes went on to atrophy of the globe. (References.) J. Wesley McKinney.

Soria. Our therapeutic management of tuberculous uveitis. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1943, v. 3, Aug.-Sept., pp. 176-184.

In the treatment of tuberculous uveitis the author relies principally on tuberculin. The initial dose is one tenth of that which gave the minimal reaction to intradermal injection. Injections are given twice weekly by the subcutaneous route. On reaching a dilution of 1 to 1000, injections are given weekly. The maximum dosage is a dilution to 1 to 100. This dose is continued for several weeks, and after a period of rest another series is given using a different tuberculin to avoid possible anaphylactic reaction. (References.) J. Wesley McKinney.

Stern, H. J. A Simple method for the early diagnosis of abnormalities of the pupillary reaction. *Brit. Jour. Ophth.*, 1944, v. 28, June, pp. 275-276. (See Section 1, General methods of diagnosis.)

Woods, A. C., and Guyton, J. S. Role of sarcoidosis and of brucellosis in uveitis. *Arch. of Ophth.*, 1944, v. 31, June, pp. 469-480; also *Trans. Amer. Acad. Ophth. and Otolaryng.*, 1944, March-April, p. 248.

Sarcoidosis is a chronic granulomatous disorder of unknown causation.

The disease is relatively benign and is capable of affecting any organ but has a certain predilection for the reticulo-endothelial system. The characteristic pathologic lesions of sarcoidosis are tubercle-like masses of epithelioid cells, usually without any surrounding caseation or necrosis. Giant cells are usually present. The presumptive diagnosis of the disease depends upon demonstration of clinical signs, of cutaneous changes, of pulmonary infiltration, of rarefactions of the bones of the hands and feet, of elevation of the globulin in the serum, and of (frequent) anergy to tuberculin.

Absolute and final diagnosis must depend upon demonstration of characteristic lesions in biopsy material, usually a lymph gland. The usual ocular manifestation is a nodular iritis, quite similar to the nodular iritis of tuberculosis. The nodules of sarcoidosis are larger, slightly pinker, and more vascularized than those of tuberculosis. The iritis is characteristically quite painless. While the process may progress to phthisis bulbi, the general tendency is more favorable and the entire process may subside without residua.

Brucellosis in man usually goes through an acute phase, characterized by fever, sweats, malaise, muscular pains, loss of weight, and various more or less vague symptoms affecting any portion of the body. Recovery may follow this phase but more commonly a chronic state of infection lasts for months or years. This is characterized by an intermittent low fever, vague pains, and lassitude. The diagnosis of brucellosis is not easy. During the acute phase the organism may be cultured from the blood. During the chronic phase diagnosis must be made from the symptoms, from a comple-

ent fixation reaction, and from tests for cutaneous hypersensitivity. The laboratory tests are not highly satisfactory during the chronic phase. The uveal tract may be involved. Often this involvement takes the form of a recurrent simple iritis, but there may be involvement of the posterior uvea and at times the process is so severe that phthisis bulbi results.

The authors studied 200 patients hospitalized with uveitis, and they have tabulated the etiologic factors. Tuberculosis leads as causative agent, with a percentage of 41.0. Other percentages are as follows: syphilis 14.0; sarcoidosis 7.5; brucellosis 7.5; foci of infection 6.0; rheumatoid arthritis 2.5; gonorrhea 6.5; miscellaneous 4.0; and undetermined 11.0.

The diagnosis was confirmed by biopsy in the 15 patients with sarcoidosis. In 15 patients the uveitis was classified as "probably" due to brucellosis. The diagnosis of chronic brucellosis is often very difficult to confirm. This series of patients consisted only of cases hospitalized, and is thought to show a higher than average incidence of sarcoidosis and brucellosis, as only the severer cases were hospitalized. The authors estimate that the actual incidence of sarcoidosis in patients with uveitis examined in the Wilmer Institute is in the neighborhood of 3 percent, and that the incidence of uveitis from brucellosis is less than 7.5 percent. The pathologic findings in one case each of uveal brucellosis and sarcoidosis are described. (References, 7 figures, 3 tables.)

John C. Long.

## 8

### GLAUCOMA AND OCULAR TENSION

Allen, T. D. The history and development of the iris-inclusion operations.

Amer. Jour. Ophth., 1944, v. 27, Sept., pp. 964-976. (Bibliography.)

## 9

## CRYSTALLINE LENS

Donahue, H. C. Bilateral cataract extraction in anterior megalophthalmos. Amer. Jour. Ophth., 1944, v. 27, Sept., pp. 1014-1019. (2 figures.)

Pike, M. H. Ocular pathology due to organic compounds. Jour. Michigan State Med. Soc., 1944, v. 43, July, p. 581.

Cataracts were produced in rabbits by oral administration of naphthalene. The progressive pathologic lens changes have been recorded by means of color photography. Although repeated exposure of rabbits to very high concentrations (4.6 to 4.8 mg.) of paradichlorobenzene vapor produced definite intoxication, leading to tremors and toxic eye-ground changes, no lens changes were observed. Prolonged oral administration of definitely toxic quantities of the drug to rabbits did not produce any lens changes whatever.

Together with the evidence gained from experimental work on animals, the experience of the author and his colleagues leads them to believe that cataracts are not produced by paradichlorobenzene, upon either oral ingestion or inhalation of its vapors, in either man or rabbit.

Theodore M. Shapira.

## 10

## RETINA AND VITREOUS

Allen, W., and Herndon, C. N. Retinitis pigmentosa and apparently sex-linked idiocy in a single sibship. Jour. of Heredity, 1944, v. 35, Feb., p. 41.

A man belonging to a family in which retinitis pigmentosa is dominant married a girl in whose family idiocy is inherited as an apparently sex-linked recessive trait. The union resulted in the production of both blind and idiot offspring. Out of 13 pregnancies seven terminated in stillbirths or were followed by death in infancy. Three sons are idiots, and one of these has retinitis pigmentosa. Both parents and the three daughters have normal mentality, and none of the daughters has retinitis pigmentosa. One daughter married and has six normal children, five of them boys. R. Grunfeld.

Cohen, Martin. Fundus oculi in urologic diseases associated with systemic hypertension. Arch. of Ophth., 1944, v. 31, May, pp. 427-431.

The purpose of this paper is to call to the attention of ophthalmologists the lesions in the fundus associated with urologic diseases. Cohen has limited his study to the consideration of three urologic diseases associated with hypertension; namely, pyelonephritis, hydronephrosis, and polycystic kidney.

There is still a question of whether the hypertension or the urologic disease or both are responsible for the fundus lesions. The author does not feel that the two should be regarded as a clinical entity, although they are frequently found together. The prognosis of the urologic disease with hypertension rests chiefly on the condition of the vital organs. The signs in the fundus are often the visible guide to the condition of the cardiovascular-renal system.

Case histories illustrative of pyelonephritis, hydronephrosis, and polycystic kidney, and the fundus picture presented in each, are given in detail.

Bilateral neuroretinopathy, possibly of inflammatory origin, was the condition in the case of pyelonephritis and that of hydronephrosis reported here, while in the case of polycystic kidney the diagnosis was bilateral chorioretinal arteriolosclerosis of noninflammatory origin. The changes in the fundus, as revealed by detailed study of these cases, are indicative of the severity of the underlying hypertensive vascular disease, regardless of the factor or factors responsible for elevation of the arterial tension.

The author feels that a report on the examination of the fundus should accompany the records of cases of urologic disease with persistent hypertension, as it is an additional aid to the diagnosis and prognosis of the disease. Interesting discussions of the article are presented by Fishberg and Elwyn. (References, 4 figures in color.)

R. W. Danielson.

Gifford, S. R. Evaluation of ocular angiospasm. *Arch. of Ophth.*, 1944, v. 31, June, pp. 453-460.

Patients with a vasoneurotic diathesis may be subject to various ocular conditions, the result of vasospasms. Such patients usually note undue distress on exposure of the extremities to cold. Their hands become white when elevated and flushed when dependent. On examination, such patients show pale hands and feet, and readings with a skin thermometer show an abnormal difference between the oral temperature and the temperature of the extremities. Such susceptible persons show a marked and abnormal drop in skin temperature after smoking cigarettes.

The author reports the cases of 23 patients in whom peripheral angiospasm is the cause of what has been

described as central angiospastic retinitis. Evidence is presented to show that peripheral vascular disease causes a certain proportion of the cases of periphlebitis retinae and recurring hemorrhages in the vitreous encountered in young adults. Extreme attenuation of the retinal arterioles with marked peripheral angiospasm was noted in one patient following cataract operation. Treatment with antispasmodic drugs produced improvement. Patients exhibiting the characteristics of any of these syndromes should be subjected to careful examination of the peripheral circulatory system.

Treatment has been directed toward relieving the vasospasm. Complete abstinence from tobacco and protection against cold are advised. Injections of papaverine, typhoid vaccine, and tissue extracts are used. Combinations of theobromine and phenobarbital are given. The nitrites have not been found as effective as other agents. Neostigmine bromide apparently is valuable. A regimen including plenty of rest and avoidance of fatigue and nervous strain is advised. (One illustration, references.)

John C. Long.

Woisika, P. H. An evaluation of the dark test. *Annals of Internal Med.*, 1944, v. 21, July, p. 101.

The author presents tables and graphs of the results of his study. The literature concerning the dark-adaptation test divides into three groups: (a) authors who believe that delayed dark adaptation as measured by existing instruments means deficient vitamin A in the diet, in metabolism, or in the reserves of the body; (b) authors who, using the same apparatus, find no correlation between vitamin A and the recorded ability to satisfy the dark test. (c) authors who, dubious of the posi-



tive correlation between vitamin A and performance on existing photometers, have offered modified apparatus of their own.

The author used 700 ambulatory patients selected at random and averaging 45.5 years; also 80 controls, healthy adults (medical students and others) averaging 26 years. Local ophthalmological conditions were excluded in all the subjects.

Biophotometer readings showed the training factor to be negligible. A higher percentage of controls than of patients had normal dark tests. This could not be ascribed to a superior dietary intake. Normal adaptation occurred in a higher percentage of patients receiving normal qualitatively estimated diets, though no strong association could be established statistically. Sex had no effect upon vision in dim light, whether diets were normal or deficient. Negroes were significantly superior in dark-test performance (but average age of negroes was less than of whites). Patients with hypertension exhibited a significantly higher percentage of poor dark-tests. Increasing age influenced dark adaptometry adversely.

The effects of various factors upon the dark test are discussed. The negative include vitamin A, diet, sex, race, and the training factor. The positive are individual factors of age, mentality, fatigue, heredity, and inherent abilities of the nervous system (oxygen consumption, retinal synapses).

Recommendations are made that further work with the rate and end values of dark adaptation be performed to establish the physiologic basis for the test rather than accepting previous work on the importance of vitamin A. A correction factor for age must be determined and must be applied in fu-

ture work with adaptometers. In the present state of knowledge of scotopic vision, the terms "night blindness" and "poor dark adaptation" should not be used synonymously as to tests.

Theodore M. Shapira.

## 11

### OPTIC NERVE AND TOXIC AMBLYOPIAS

Morrison, L. F. Optic neuritis and the ethmoid sinuses. *Jour. Nervous and Mental Dis.*, 1944, v. 99, May, p. 786.

The author emphasizes the fact that in the treatment of optic neuritis rhinologic surgical intervention should be undertaken only after exclusion of all other possible sources of infection. The technique for submucous resection and bilateral ethmoidectomy is described. Brief data are presented on 39 patients who had submucous resection and ethmoidectomy; in only nine of these patients was there no definite improvement in the visual signs or symptoms. In none of the sinus operations was any marked pus or gross pathology encountered. It is interesting to note, in view of the represented diagnosis of optic neuritis in these cases, that a good number of them are listed as having disc elevations of 4, 5 and 6 diopters. Benjamin Milder.

Wilkinson, P. B. Amblyopia due to a vitamin deficiency. *The Lancet*, 1944, v. 246, April 22, pp. 528-531.

In Hong Kong during the last half of 1940, 15 patients were carefully studied by the author. Generally speaking, they had bilateral sight failure of several months or less, pupillary sluggishness, concentrically contracted fields with central or paracentral scotoma, and for the most part normal discs. All were on diets unsat-

isfactory in quantity or quality, or both. Deprivation of first-class proteins was considered an important factor in the causation of their ocular symptoms. Practically all of these patients' ocular symptoms were greatly improved or cured in from two to six weeks upon an adequate diet supplemented by riboflavin, nicotinic acid, and other components of the B group. Nicotinic acid in 100-mg. doses daily seemed to be followed by greater visual improvement than riboflavin. These cases suggest that the condition is largely due to disturbance in the second link of the co-enzyme oxidase system, which disturbance is also responsible for pellagra. Why the ocular symptoms are so relatively infrequent is no known.

Charles A. Bahn.

## 12

### VISUAL TRACTS AND CENTERS

Esteban, Mario. Hemianopsia of allergic origin. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1943, v. 3, Sept.-Oct., pp. 167-169.

A patient previously subject to edema of the eyelids had severe headaches, nausea, and vomiting, followed by impairment of vision. A homonymous hemianopic scotoma and a quadrant defect were found in the visual fields. A skin test made with a suspension of organisms isolated from obviously diseased tonsils gave a strongly positive reaction. Treatment consisted of tonsillectomy and giving an autogenous vaccine prepared from the tonsils. There was no recurrence of the symptoms in three years of observation. (Fields.)

J. Wesley McKinney.

Harrington, D. O. Wartime ocular neuroses. *Jour. Nervous and Mental Dis.*, 1944, v. 99, May, p. 622.

This article emphasizes the high percentage of neuroses and other borderline mental conditions encountered in wartime, among civilians as well as those in service. Conversion hysteria generally is centered on an organ or function which the patient knows or believes to be defective. It is therefore commonly focused on the eyes, the characteristic complaint being amaurosis. It is usual to find "tubular" functional visual fields. Restoration to normal can generally be promoted by suggestion.

The author mentions two current, divergent views on malingerers, ocular or otherwise. One view is that they have a constitutional psychopathic inferiority, the other is that these patients are criminal offenders. Ciliary spasm is represented as a cause of "asthenopia" which has in the majority of cases a psychogenic basis. Photophobia, too, is mentioned as a disturbance which is usually part of a symptom complex having an organic basis but frequently psychogenic in origin.

Combat fatigue ("shell shock") does not, as a rule, show ocular manifestations—but there may be temporary visual loss, often recurring in transient episodes. Each of the types of wartime ocular neurosis described in the paper is illustrated with a typical case history.

Benjamin Milder.

## 13

### EYEBALL AND ORBIT

Converse, J. M. Two plastic operations for repair of orbit following severe trauma and extensive comminuted fracture. *Arch. of Ophth.*, 1944, v. 31, April, pp. 323-325.

War injuries of the middle third of the face may result from motor and

aviation mishaps as well as from bullets or bomb fragments. The author describes the method by which two extensive mutilating wounds of this region were treated.

A man of 23 years was struck by a bomb fragment in the preauricular region. The particle penetrated the orbit and the nasal cavity and emerged through the lateral aspect of the nose on the opposite side. When examined six months later, the remains of the nasal bone and the ascending process of the maxilla were found pushed into the ethmoid sinus. The whole region of the inner canthus of the left eye was widened and the eyeball seemed to be pushed laterally. Under local anesthesia an incision about 5 cm. in length was made, starting laterally and extending to the medial end of the eyebrow. Subperiosteal elevation of the tissues was done and protruding bone was resected until the bony wall appeared to be on the same plane as the os planum farther back. The remains of the lacrimal sac were removed, and the internal palpebral ligament was sutured to the remaining periosteum with a 35-gage stainless-steel wire. The operation resulted in elimination of the unilateral mongoloid appearance.

The second patient was a man of 21 years who had had a comminuted fracture of the left malar bone with depression into the antrum. The left eyeball was lower than the right and the floor of the left orbit 18 mm. lower than the floor of the right. Diplopia was constant, necessitating the wearing of a patch over the left eye. This defect was corrected by subperiosteal insertion of a bone graft into the damaged floor of the orbit, the bone being obtained from the inner table of the ilium. Following the operation, diplo-

pia disappeared except in extreme upward gaze and there was considerable improvement in appearance. Both operations are well illustrated by drawings and photographs. (6 figures, references.)  
John C. Long.

Edelson, David. Staphylococcal thrombophlebitis of the cavernous sinus. *Arch. of Ophth.*, 1944, v. 31, April, pp. 329-330.

A woman aged 20 years picked a pimple on the left side of her forehead. Pain developed that day in her head and left eye. On the following day, the typical signs of cavernous sinus thrombosis were present. The patient was violently ill with a temperature of 105.4°F. *Staphylococcus aureus* was grown from cultures of the spinal fluid. Sulfathiazole was given by mouth and intravenously and large doses of sulfadiazine were given by mouth. A total of 45,000 units of heparin was given during the first month of hospitalization. The patient received 150.5 gm. of sulfathiazole during a period of five weeks and 498 gm. of sulfadiazine during a period of four months. For eight weeks the temperature fluctuated between 100° and 104°F. During the eleventh week it fell to 99°F., after which time it was essentially normal. Six months after the onset of the illness the right eye was quite normal except for a trace of chemosis at the inner canthus. The left eye was moderately proptosed and the cornea was scarred from exposure. There was ptosis of the lid, the pupil was dilated and fixed to light, the vertically acting recti and the inferior oblique muscle were completely paralyzed. The superior oblique muscle showed a trace of function. The author states that it will be necessary to give heparin a more extensive clinical trial to deter-

mine its value in such cases, but that its use is indicated on theoretical grounds. (3 photographs.)

John C. Long.

Flynn, Richard. Graves's disease with dissociation of thyreotoxicosis, and ophthalmopathy associated with myasthenia gravis. *Med. Jour. Australia*, 1944, v. 1, April 15, pp. 344-346.

Bilateral exophthalmus, right ptosis, and left rectus paralysis, associated with Graves's disease, were increased after partial bilateral thyroidectomy. Following further removal of the thyroid, prostigmin injections, and thyroid medication, the ophthalmic and constitutional symptoms practically disappeared over a period of three years.

Chas. A. Bahn.

Kraus, J. An operation for shrunken socket. *Brit. Jour. Ophth.*, 1944, v. 28, May, pp. 224-228.

The socket is stretched by means of a cavity dilator which produces a circular force from within outward, without undue pressure on the eyelids. (11 drawings.)

Edna M. Reynolds.

Mulvany, J. H. The exophthalmos of hyperthyroidism. *Amer. Jour. Ophth.*, 1944, v. 27, June, pp. 589-612; July, pp. 693-712; Aug., pp. 820-832. (28 figures, extensive bibliography.)

Soley, M. H. Exophthalmos secondary to edema and degenerative changes in orbital tissues. *Jour. Nervous and Mental Dis.*, 1944, v. 99, May, p. 865.

A series of 37 patients presenting marked degrees of exophthalmos is analyzed from the standpoint of etiology, type of treatment, and indication for orbital decompression (Naffziger). Of the series, 24 with hyper-

thyroidism had subtotal thyroidectomy. Ten had X-ray therapy. Half of the entire group showed progression of the exophthalmos after treatment of the hyperthyroidism—most of them having postoperative hypothyroidism or frank myxedema. They were not helped by substitution thyroid therapy. For this reason, the chosen procedure in thyrotoxicosis is X-ray therapy, to avoid the complications of myxedema. In large or nodular goiters, operative treatment is still indicated.

Orbital decompression is indicated where there is paresis of the extrinsic muscles, impaired vision, marked chemosis of the conjunctiva or lid edema, or corneal ulceration.

Benjamin Milder.

Soto, M. C. Typical multiple bilateral coloboma. *Anales Argentinos Oft.*, 1943, v. 4, July-Aug.-Sept., pp. 106-111.

A six-year-old female showed a bilateral congenital coloboma involving inferiorly the iris, lens, choroid, and optic disc. The author presents an effective academic discussion of the genesis of this type of congenital defect.

Edward Saskin.

## 14

### EYELIDS AND LACRIMAL APPARATUS

Cordes, F. C., and Fritsch, U. Dickey operation for ptosis. *Arch. of Ophth.*, 1944, v. 31, June, pp. 461-468; also *Trans. Amer. Acad. Ophth. and Otolaryng.*, 1944, 48th mtg., March-April, p. 266.

The Dickey operation for ptosis makes use of the superior rectus as an elevator of the lid. A strip of fascia lata is inserted beneath the middle third of the superior rectus tendon and the ends of the fascia strip are secured to the anterior surface of the tarsus. In this

way the tarsus is connected to the superior rectus by a hammock of fascia. A detailed, illustrated description of the technique is given.

This operation has been used extensively at the University of California for the past eight years. During this time thirty lids have been operated on in 21 patients, with satisfactory results. The youngest patient of this series was a child 13 months old. Permanent diplopia occurred in only three cases; in two of these it was present only on extreme elevation of the lid, and in the third the diplopia was inconstant. Because of the double attachment on the tarsus, there is no tendency to formation of an inverted V at the lid margin, as is at times observed with the Mouton operation. The Dickey operation has been found satisfactory in cases of bilateral complete ptosis, unilateral complete ptosis, and partial ptosis when the action of the superior rectus muscle was normal. (References, 7 illustrations.)

John C. Long.

Kirby, D. B. Vertical shortening deformities of the eyelids. *Surg. Clin. North Amer.*, 1944, April, pp. 348-369.

The importance, in any plastic procedure, of a thorough knowledge of the surgical anatomy of the lids and surrounding structures is emphasized, as well as the rule never to add a deformity in correcting a deformity. Salient principles in care of eye and lid wounds are stressed. Early plastic procedures are always indicated to protect an exposed cornea. If the eyeball is safe, procedures may be delayed preferably until resolution of the fibroblastic process is complete, since operation prior to this frequently adds more scar.

The principles of lid surgery, including delicacy in handling tissues, use of

sutures, and hemostasis, are reviewed. Optimum sites for donor grafts are discussed. Use of skin from intact lids is preferred, next best being from the temple, the cephalo-auricular angle, and last from the thigh. Preparation of an adequate bed following loss of tissue is advised, using transplants of fascia lata, cartilage, or fat.

The technique of lid closure by adhesion is well illustrated. The desirability of removal of the nasolacrimal sac if obstructed and infected is stressed as a precursor to any operative procedure around the eye or lids. The main surgical principles in correction of cicatricial ectropion (upper and lower), ptosis, epicanthus, ankyloblepharon, and entropion, are given, as well as those for correction of colobomata and symblepharon. Use of grafts of buccal mucosa is likewise generally discussed. (Bibliography.)

Owen C. Dickson.

Waldapfel, Richard. Rhinocanalicular anastomosis. *Arch of Ophth.*, 1944, v. 31, May, pp. 432-433.

Waldapfel gives an evaluation of the new technique for operations on the tear passages recently reported by Blumenfeld (*Amer. Jour. Ophth.*, 1944, v. 27, p. 1043). Obstruction in the tear passages may be situated in the following places: in the canaliculi, in the upper part of the lacrimal sac, adjacent to the canaliculi, or in the lower part of the sac and in the nasolacrimal duct.

The author feels that the old procedures (West, Toti, Mosher, Halle) are the most satisfactory when the obstruction is at the nasolacrimal duct. However, he adds that he feels Blumenfeld's new technique should definitely be considered when the obstructions occur in the canaliculi or in the upper part of the tear sac near the openings

of the canaliculi. (One reference, 3 figures.)

R. W. Danielson.

Winton, S. S. **Monocular myasthenia gravis.** Jour. Amer. Med. Assoc., 1943, v. 122, Aug. 21, p. 1180.

It is pointed out that occasionally myasthenia gravis may present only ocular symptoms, and that these may sometimes be monocular. A case report is given in which the only sign was monocular ptosis. In such cases a diagnostic intramuscular injection of 1.5 mg. of prostigmine methylsulphate is suggested as a simple and reliable test. This gives subjective and objective improvement within an hour. The author states that symptoms in his case were held in abeyance by a combination of 15 mg. of prostigmine bromide and 0.1 gm. of guanidine hydrochloride taken three times daily with meals. He is unable to state whether or not more widespread involvement would have occurred in the absence of specific therapy.

Robert N. Shaffer.

## 15

### TUMORS

Foster, J. **An encapsulated orbital melanoma.** Brit. Jour. Ophth., 1944, v. 28, June, pp. 293-296.

The patient, aged 65 years, showed 7 mm. of exophthalmos of the right eye, with displacement slightly up and in, paresis of the inferior rectus, mydriasis, and vision of 6/24. Orbital exploration by the transpalpebro-conjunctival route of Félix Lagrange revealed an encapsulated tumor about the size and shape of a date-stone, situated on the outer side of the external rectus. The tumor, although melanotic, was strongly encapsulated.

One pathologist considered the tumor malignant, but Parsons considered it nonmalignant and felt that it might have originated as an orbital dermoid. Loewenstein regarded the tumor as nonmalignant, a mixed-cell type displaying both ectodermal and mesodermal features. (2 photomicrographs.)  
Edna M. Reynolds.

Griffith, A. D., and Sorsby, A. **The genetics of retinoblastoma.** Brit. Jour. Ophth., 1944, v. 28, June, pp. 279-293.

An analysis of the cases of retinoblastoma seen at the Royal Eye Hospital in London over the fifty-year period from 1894 to 1943 is given. The total number of cases, 59, included one family in which the tumor occurred in three successive generations. In this family there were six instances of retinoblastoma, five of them bilateral. The remaining 53 were isolated sporadic cases. Among these 53 cases there were eight which were bilateral. The mode of inheritance is shown to be irregularly dominant, since these tumors occur in children of parents themselves unaffected but having a family history of the affection. It is suggested that hereditary retinoblastoma is a distinct histologic entity different from the sporadic types. (3 charts, 3 tables, bibliography.)  
Edna M. Reynolds.

Herbst, W. P. **Malignant melanoma of the choroid with extensive metastasis treated by removing secreting tissue of the testicles.** Jour. Amer. Med. Assoc., 1943, v. 122, June 26, p. 597.

A man aged 69 years had a malignant melanoma of the choroid. The eye was removed and the tumor studied microscopically. The cells were spindle-cell subtype B, and large and small epithelioid cells; and the tumor had less than 50 percent of argyrophile

fibers. No extrabulbar extension was demonstrated. Metastases to orbit, liver, and the entire surface of the body appeared, and by the end of the third year the patient was practically moribund. At that time the entire left testicle and the secreting tissue of the right testicle were removed. Subsequently there was no further nausea; food was retained; there was no more fluid coming from the respiratory tract; there was definite regression of some of the metastatic lesions, and no new ones developed. The patients died suddenly two months later. The author states the case is not presented with any idea of claiming to comprehend the chemical mechanism involved, but simply as an interesting clinical observation.

Robert N. Shaffer.

Póvoa, Hélio, and Paulo, Jr. **Diagnosis of ocular neoplasms by Botelho's reaction in the aqueous humor.** *Rev. Brasileira de Oft.*, 1944, v. 2, June, pp. 193-201.

This is a reprint of an article which appeared in August, 1931, in the *Revue Sud-Américaine*. The article, which was in French, is reproduced in memory of the late Prof. Hélio Póvoa.

Roberts, W. L., and Wheeler, J. R. **Report of a case of a primary carcinoma of the lacrimal sac.** *Brit. Jour. Ophth.*, 1944, v. 28, May, pp. 233-236.

A summary of the cases of primary tumor of the lacrimal sac reported to date is given. The patient was a 49-year-old white male. A dacryocystectomy was done with complete removal of the tumor mass, which had invaded the lacrimal bone. Surgery was followed by the use of radium. (2 illustrations, references.)

Edna M. Reynolds.

## 16

### INJURIES

Appelbaum, Alfred. **The simplest instrument for the removal of foreign bodies in the cornea.** *The Military Surgeon*, 1943, v. 93, Dec., p. 479. (See *Amer. Jour. Ophth.*, 1943, v. 26, Dec., p. 1352.)

Eccles, J. O., and Flynn, A. J. **Experimental photoreinitis.** *Med. Jour. Australia*, 1944, v. 1, April 15, pp. 339-342.

Lookouts for airplanes, and also eclipse observers, occasionally develop photoreinitis. This condition, first described by Galen, is caused by heat and not by ultraviolet radiation. The amount of heat and the time necessary to produce retinal lesions were studied in anesthetized rabbits. These were given four exposures to the midsummer midday sun in such a way that its images would lie at the four corners of a square. There resulted a lesion 0.14 mm. in diameter which could not be verified without magnification. By magnifying the sun's image ten times, 1.4-mm. image was obtained, which produced definite retinal lesions. The eyes were examined ophthalmoscopically daily for three to six days until the rabbits were sacrificed. With a 2-mm. pupil and exposure to 70 calories per sq. cm., severe lesions resulted in two minutes, less severe lesions in 30 seconds, and no lesions were observed after 3-seconds exposure. On exposure to direct sunlight, the human pupil contracts to from 1.6 to 2 mm. The retinal image of the sun would thus represent 100 calories per sq. cm. per minute. No detectable lesion would be produced by 30 seconds irradiation. Momentary glances across the sun will not produce retinal lesions. If longer



observation is necessary, glasses with high absorption powers both for visible and infrared radiation must be used.

Charles A. Bahn.

Clark, C. P. Industrial and domestic injuries of the eye. *Jour. Amer. Med. Assoc.*, 1944, v. 124, Jan. 15, p. 157.

The author mentions various ocular injuries occurring in home and factory. He states that a well-trained nurse or physician should care for all but the most trivial injuries, to reduce complications and shorten convalescence. He briefly describes the accepted principles of treating the various injuries, stressing that particular care should be taken to avoid sympathetic ophthalmia.

Robert N. Shaffer.

Clements, A. F. Eye trauma in amphibious troop operations of the U.S.S. Solace. *Jour. Indiana State Med. Assoc.*, 1944, v. 37, Aug., p. 404.

In the group under study aboard this U.S. Navy hospital ship, 984 patients were seen with various battle injuries and of this number 48 received ocular trauma. Considering the type of resistance met, with mortar shells, hand grenades, and rifle bullets, and in view of the fact that 120 patients in this group had facial wounds, the percentage of eye injuries is low.

Of the 48 patients with eye injuries some had extraocular foreign bodies in one eye and intraocular or penetrating in the other. Only four patients were seen with bilateral penetrating intraocular trauma sufficient to cause permanent total blindness. Twenty-three eye injuries were nonpenetrating and 33 penetrated the eyeball. The fighting man must see at what he is shooting and also when he is being attacked. This obviously must expose the eyes.

Foreign bodies seen were brass, coral, cast iron, or lead, some non-magnetic and so presenting a difficult problem in their removal. Usual prompt healing followed removal of small metallic foreign bodies. Coral foreign bodies are not easily removed from the cornea or sclera. Their dislodgment involves added trauma and healing is much slower. Delay of 24 to 48 hours, which facilitates removal of metal, cinders, and sand, fails to aid with coral. The coral is apparently fairly well tolerated by the cornea, although subjectively as painful as any other foreign body. Since average stay at the hospital ship was only seven days, final healing results can not be reported.

Theodore M. Shapira.

Harkness, G. F. Industrial ophthalmology and otolaryngology. *Illinois Med. Jour.*, 1944, v. 85, March, p. 124. (See Section 18, Hygiene, sociology, education, and history.) (See *Amer. Jour. Ophth.*, 1944, v. 27, March, p. 335.)

Johnson, M. R. Depressed fracture of the orbital rim. *Surg. Clin. North America*, 1944, v. 24, April, pp. 340-347.

Fractures of the malar bone with depression of the floor of the orbit should be treated early if cosmetic damage and operative procedures are to be avoided. If the malar bone is not comminuted simple replacement by means of pressure with a blunt elevator intraorally or by attachment of a screw to the bone through a small skin incision is effective. If comminuted, the fragment will usually not remain in position without some form of fixation. The common methods consist of packing the antrum with iodoform gauze and later removal either through a Caldwell-Luc incision or an antrum

window, after fibrous union has occurred.

The author reports a modification of this procedure in a case of comminuted fracture of the left superior maxilla. Ten days after injury, on subsidence of ecchymosis and edema and improvement of the patient's general physical condition, depression of the orbital floor became quite apparent and allowed a vertical muscle imbalance of 5 prism-diopters. Replacement of the depressed fragment was easily possible through either the Caldwell-Luc approach or the antral window made intranasally, but unless supported the fragment would not retain its position.

The end of a rubber glove finger tied at the tip of a catheter was inserted into the antrum and the catheter led out of the nostril through the antral window. Filling of this "balloon" with 20 c.c. of water maintained the fragment without complication. Upon removal of the balloon three weeks later the functional and cosmetic result was good. One diopter of hypophoria for near only remained.

Owen C. Dickson.

Kinsey, V. E., Cogan, D. G., and Drinker, P. Measuring eye flash from arc welding. *Jour. Amer. Med. Assoc.*, 1943, v. 123, Oct. 16, p. 403.

The authors have investigated the dosage of radiation from electric welding arcs necessary to produce symptoms. It was found that the ultraviolet production fairly closely paralleled the production of visible light. For convenience a Weston light-meter calibrated in foot candles was used to measure dosage in terms of foot-candle minutes. After preliminary animal experiments 12 young men were irradiated. It was found that an exposure coefficient of 200 foot-candle minutes

was required to produce minimal ocular damage consistently in man. In actual practice this represented a 30-second exposure at a distance of 7 feet with the welding machine used in the testing. As to time and intensity of radiation, a minimum standard of safety for men in the neighborhood of electric welding arcs has been recommended as one tenth that required to produce minimal ocular effects. It is stressed that ultraviolet dosage is additive within a 24-hour period, and that, since the time of exposure necessary to produce symptoms is not consistent with the general idea of "flash" exposures, this term must be considered a misnomer.

Robert N. Shaffer.

Linhart, W. O. Emphysema of the orbit. *Jour. Amer. Med. Assoc.*, 1943, v. 123, Sept. 11, p. 89.

Following trauma to the orbital region, orbitopalpebral emphysema occasionally occurs. This is due to fracture of the nasal orbital wall, following which air is forced into the subcutaneous tissue by blowing the nose. The author reports seven cases of such emphysema, with X-ray stereoscopic studies which failed to show definite fracture lines into the nasal cavity. However such fractures were assumed to be missed because of the difficulty of demonstration of fractures by X ray of the medial orbital wall. All patients recovered uneventfully in ten days.

Robert N. Shaffer.

O'Hea-Cussen, V. Removal of a non-magnetic foreign body from the vitreous. *Brit. Jour. Ophth.*, 1944, v. 28, June, pp. 296-298.

The following technique was used. Immediately over the estimated position of the foreign body two catgut

sutures, 2 mm. apart, were placed in the superficial layers of the sclera. With a cataract knife, an incision one-fourth inch long was made in the sclera between the sutures. This was deepened until the choroid was exposed. While the operator held one suture and the assistant the other, gentle vertical traction was made. Next, the choroid and retina were incised along the full length of the scleral incision. The foreign body was removed with a narrow curette and the scleral sutures were tied and the conjunctival flap replaced. The loss of vitreous was small, not more than two or three drops. Examination of the foreign body showed it to be a piece of stone, an exact 2-mm. cube except that the fifth and sixth sides were slightly longer and tapered to a point. After six weeks hospitalization, the vision was 6/24, improved with a lens to 6/18. The scleral sutures appeared to reduce vitreous loss. Edna M. Reynolds.

Rieke, F. E. "Arc flash" conjunctivitis. *Jour. Amer. Med. Assoc.*, 1943, v. 122, July 10, p. 734.

The author discusses actinic conjunctivitis or "arc flash" as he has seen it among the 57,000 workers in the Oregon Shipbuilding Corporation and the Kaiser Company in Portland. Treatment for this condition made up over 30 percent of all dispensary treatments, which have totaled over 500,000 in 21 months. An average of two to four working days was lost per case.

It is rare for the first brilliant contact spark of the welder to produce the condition, though this is the common misconception of both the workmen and many doctors. Rather it is usually caused by ultraviolet bombardment over a period of time varying from a few minutes to a few hours.

There is typically delayed onset of symptoms, self-limited course of 24 hours, pronounced bulbar hyperemia, swelling of the lids, slight sunburn of the face, absence of discharge other than tears, extreme photophobia, and feeling of sand in the eyes. Treatment is given for relief of symptoms through dark glasses, cold applications, and the use of a local anesthetic, together with vasoconstricting, mydriatic, lubricating, and sedative preparations. Prophylaxis is accomplished by means of protective shields and lenses, and by explanation to the workers of the hazards involved and of the methods for avoiding them. Robert N. Shaffer.

## 17

## SYSTEMIC DISEASES AND PARASITES

Allen, W., and Herndon, C. N. Retinitis pigmentosa and apparently sex-linked idiocy in a single sibship. *Jour. of Heredity*, 1944, v. 35, Feb., p. 41. (See Section 10, Retina and vitreous.)

Eagan, E. F., and Halpern, H. J. Iritis, retinal hemorrhage, and changes in the lens following injection of typhus vaccine. *Arch. of Ophth.*, 1944, v. 31, April, pp. 336-337.

A white soldier aged 22 years developed redness and pain of the right eye 36 hours after injection of 1 c.c. of typhus vaccine. Within a week there was no light perception, the pupil was dilated, and there were posterior synechiae and small deposits of iris pigment on the anterior surface of the lens. The vitreous was cloudy and the fundus was seen indistinctly. There was a large, whitish patch resembling exudate over the disc and macular area. Later, early opacities of the lens were observed. No systemic cause for

the disorder could be found. The left eye remained normal. After three weeks there was no improvement in the condition and the patient was discharged from the army. (References.)

John C. Long.

Frouchtman, R. Report of study of allergic etiopathogenesis in some ocular affections. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1943, v. 3, Sept.-Oct., pp. 157-166.

The considerations here presented are based on a study of 30 cases of ocular allergy. Of these cases, 16 were of conjunctivitis, 6 blepharoconjunctivitis, 4 blepharitis, 2 keratitis, and 2 keratoconjunctivitis. Given an allergic individual who has developed certain specific sensitivities, there are three factors which may precipitate and maintain allergic reactions, viz. hepatobiliary affections, focal infections, and various physical agents. It is thought that diminished flow of bile as a result of poor liver function or gall-bladder affection may condition a sensitivity to incompletely digested or absorbed intestinal contents. The therapeutic indication in this case is reduced to a hepatic dietary régime plus measures to stimulate the flow of bile. In 13 patients, the hepatobiliary intestinal factor was important, the role of focal infection not so definite. The removal of obvious foci of infection, although followed at times by more or less marked improvement, was all too often without influence on the allergic reaction. Various physical agents such as heat, cold, and sunlight may activate a reaction in an individual whose allergy might otherwise be in a state of equilibrium. The same may be true of changes in atmospheric conditions, emotions, or menstruation. Finally an individual may become sensitive to the

products of the normal bacterial flora of the conjunctiva and skin of the lids, which with the above-mentioned contributing factors determine a progressive hypersensitivity, weakening of tissue resistance, and increasing bacterial virulence. (References.)

J. Wesley McKinney.

Linehart, W. O. Conjunctivitis and keratitis of allergic origin. *Arch. of Ophth.*, 1944, v. 31, May, pp. 403-407.

Allergic tests were made on a series of 37 patients with acute or chronic conjunctivitis and 17 patients with keratitis. Allergic desensitization produced improvement in all but six, each of whom was sensitive to various substances. (References, 2 tables and 1 figure.)

R. W. Danielson.

Sherman, H., and Baron, B. Studies in hypersensitiveness of the mucous membrane. 5. Comparative studies of skin and ophthalmic reactions in hay fever patients. . . . *Jour. of Allergy*, 1944, v. 15, May, p. 163.

Forty treated hay-fever patients who had at one time shown constitutional symptoms such as nasal or bronchial-mucosa signs, urticaria, or pruritus were studied to determine if an abnormal degree of reactivity existed in either the cutaneous or the mucosal shock tissues.

Normally skin is found to react to allergen dilutions ten to one hundred times weaker than those required for conjunctival reaction. Comparison of cutaneous with mucosal sensitivity, using the conjunctival sacs, revealed that in 50 percent of the forty cases there was an alteration of the skin-mucosa sensitivity ratio. This indicates that in constitutionally reacting patients there is either a reduced skin reactivity or an increased conjunctival

sensitivity. The latter is suspected.

Duration of treatment and nature of constitutional reaction were not factors. Only 17 percent of a control group without constitutional reactions showed similar reduction in the skin-mucosa ratio. Criteria for classification of the severity of conjunctival reactions are given. Owen C. Dickson.

Stewart, F. H. Dengue; analysis of the clinical syndrome at a South Pacific advance base. U. S. Naval Med. Bull., 1944, v. 42, June, pp. 1233-1240.

The ophthalmic symptoms mentioned include bilateral supraorbital headaches and palpebral edema. Conjunctival injection, photophobia, and lacrimation are usually slight. Association of ocular tenderness and pain with ocular movement is frequent.

Charles A. Bahn.

Weiss, Charles. Laboratory aids in the diagnosis of infections of the eye prevalent in tropical and subtropical countries. Amer. Jour. Clin. Path., 1944, v. 14, April, pp. 200/213. (See Section 1, General methods of diagnosis.)

Wilkinson, P. B. Amblyopia due to a vitamin deficiency. The Lancet, 1944, v. 246, April 22, pp. 528-531. (See Section 11, Optic nerve and toxic amblyopias.)

Woods, A. C. and Burky, E. L. Experimental studies of ocular tuberculosis. 8. A study of the increased resistance to reinoculation after recovery from ocular tuberculosis shown by the immune-allergic rabbit. Arch. of Ophth., 1944, v. 31, May, pp. 413-422.

An experimental study of the increased resistance manifested by the eyes of rabbits which had recently re-

covered from an attack of ocular tuberculosis revealed that this increased resistance was transitory, gradually diminishing after four months and completely absent after one year.

In this experiment, two groups of immune-allergic rabbits were prepared. The first group, A, was composed of immune-allergic rabbits which had recovered from an attack of ocular tuberculosis in one eye. These eyes were scarred and vascularized but the disease had been clinically inactive for an average period of six weeks. The second group, B, consisted of immune-allergic rabbits with nontuberculous vascularization of one eye. The control group, C, was made up of immune-allergic rabbits which had received no previous ocular injections. As additional controls, normal rabbits were inoculated in the eyes. The eight subgroups were inoculated at two-week intervals for a period of 16 weeks. The eyes of all rabbits were examined clinically each week.

Briefly the results were as follows: A more severe reaction was noted in the more highly vascularized eyes of the rabbits in group B than in the eyes of the rabbits of group A. It would appear that vascularization in itself was not responsible for the relative resistance to reinoculation shown by the rabbits in group A. In the previously normal left eyes there developed the usual ocular tuberculosis exhibited by other immune-allergic rabbits when similarly inoculated. The one positive result in these experiments is the observation that the resistance to reinoculation manifested by recently recovered eyes is a transitory phenomenon. The authors conclude that the resistance shown is related to the persistence of active, but subclinical, tuberculous disease. If this concept of

the process is applied to ocular tuberculosis in man, the obvious lesson to be learned is that the apparent healing of a tuberculous lesion, with subsidence of clinical evidences of activity, should not be regarded with too much complacency. The eye has passed only into the first phase of the healing process, with transitory resistance to reinoculation, dependent probably on premobilization of macrophages. (References, 7 figures, 2 tables.)

R. W. Danielson.

# 18

## HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Bigelow, M. H. Recent developments in the prevention of blindness program. *Sight-Saving Review*, 1943, v. 13, Fall-Winter, p. 187.

In addition to the usual program for education, community aid, and improvement of hygiene in home, school, and industry which the Society for the Prevention of Blindness routinely follows, certain problems have been stressed during the past year. The society has distributed educational material covering the early symptoms of glaucoma and suggesting the need for proper care. In the field of industrial eye safety emphasis is being placed on the use of eye examinations to increase efficiency, and also on the establishment of adequate standards of eye function for various industrial purposes. Safety programs and courses on eye hygiene have been planned for presentation to industrial and educational groups. Owen C. Dickson.

Gradle, H. S. A visual service for small manufacturing plants. *Jour. Amer. Med. Assoc.*, 1944, v. 125, May 27, p. 253.

Because small industrial plants sel-

dom have an efficient medical and safety department, the Illinois Society of the Prevention of Blindness set up a service to try to aid these smaller plants in the elimination of visual hazards. The society carries part of the expense and the management contributes. The service is briefly as follows: (1) After the management has accepted the service a tester conducts a visual survey of each employee. (2) A safety engineer surveys the plant for industrial hazards. (3) A medical analysis of the report of the vision tester is made out for each employee, with specific suggestions for needed corrections. Suggestions for correction of plant defects are made by the industrial engineer. (4) A safety campaign by posters, pamphlets, and so on, is used to stimulate coöperation on the part of the employees.

Robert N. Shaffer.

Greear, J. N., Jr. Rehabilitation of war-blinded soldiers. *Outlook for the Blind*, 1944, v. 38, May, p. 121.

Rehabilitation of the newly blinded soldier is started at the Valley Forge Hospital as soon as it has been ascertained that the loss of vision is permanent. The program of rehabilitation is divided into three periods. The aim in the primary period is that the soldier shall make a satisfactory psychologic adjustment to his loss of vision. He is guided in learning to arrange and take care of his personal effects and of himself. Early stress is laid on motivation indoors as well as outdoors with the aid of a cane. During the intermediate period the pupil receives instruction in Braille, typing, workshop training. To thwart any tendency toward poor speech patterns, discussions are cultivated and social activities encouraged. In the advanced period the

soldier is given higher educational training for a specialized vocation.

R. Grunfeld.

Griffis, Enid. When the blind soldier goes home. *Outlook for the Blind*, 1944, v. 38, March, p. 74.

The blinded soldier is well taken care of as long as he is hospitalized. In the Valley Forge General Hospital at Phoenixville, Pa., and in the Letterman General Hospital at San Francisco, everything is done to nurse him back to health. Under the sympathetic direction of trained workers he learns how to feed, dress, and care for himself, to get about alone in familiar surroundings, and to read and write Braille. A problem arises when the soldier goes home and tries to adjust himself to a new life in the community. At this point the social worker can help. He should make every endeavor to bring the sightless soldier immediately into contact with the nearest Veterans' Administration Facility, where rehabilitation and vocational training are centered. It should be, furthermore, the social worker's duty to guard against outbursts of emotionalism. Misguided and uninformed individuals may endeavor to raise funds and form new organizations designed to aid the war-blind. The social worker should at once point out to those responsible that such movements are not only unnecessary but undesirable, since they serve only to confuse and diffuse the total effort in behalf of the sightless.

R. Grunfeld.

Harkness, G. F. *Industrial ophthalmology and otolaryngology*. *Illinois Med. Jour.*, 1944, v. 85, March, p. 124. (See *Amer. Jour. Ophth.*, 1944, v. 27, March, p. 335.)

Hillman, C. C. The Army rehabilitation program for the blind and the deafened. *Jour. Amer. Med. Assoc.*, 1944, v. 125, June 3, p. 321.

As evaluated by the army, blindness is considered to be present when vision is 20/200 or less in the better eye. The number of cases of blindness in our Army in this war is still small, 73 cases having been recorded by March 1, 1944. Valley Forge General Hospital (Phoenixville, Pennsylvania) and Dibble General Hospital (Menlo Park, California) are the two specially staffed and equipped ophthalmic hospitals which receive all newly blinded casualties. A reporting system to the Surgeon General insures that all cases are found and transferred to these special hospitals for necessary medical and surgical care and initiation of social rehabilitation. Following the necessary hospitalization, a facility for further social rehabilitation of the blind is being set up by the Army to care for their own blind and also those of the Navy and the Marine Corps. The program will provide for social adjustment, teaching of Braille, and pre-vocational training. A similar program is being prepared for the deafened.

Robert N. Shaffer.

Kirby, D. B. *The American Board of Ophthalmology in relation to prevention of blindness*. *Sight-Saving Review*, 1943, v. 13, Fall-Winter, p. 174.

The American Board of Ophthalmology has been a stimulus to graduate education and study of ophthalmology, and to the advancement of teaching and research. Although certification by the Board has no legal status the moral suasion incident to being declared safe for practice, diagnosis, and therapy of eye cases has undoubtedly raised the general standard of the spe-



cialty and contributed much to the prevention of blindness.

The relationship of the American Board of Ophthalmology to the American Board of Medical Specialties is explained. Owen C. Dickson.

Mackenzie, Clutha. Outposts for the blind of Hindustan. Outlook for the Blind, 1944, v. 38, June, p. 156.

The author describes a journey through India which he undertook in order to study the scattered schools for the blind which take care of twelve hundred out of India's two million blind population. R. Grunfeld.

Maitland, R. F. A country schoolmaster: Theodore H. Maitland. Outlook for the Blind, 1944, v. 38, June, p. 163.

The author's father, who had one fourth normal vision, read ordinary print, taught successfully in an elementary school, and later organized a high school and became its principal. R. Grunfeld.

Mumford, E. W. Nursing care of eye in industry. Sight-Saving Review, 1943, v. 13, Fall-Winter, p. 165.

Standard procedures for first-aid treatment of eye injuries most commonly seen in industry are discussed from the nursing standpoint. Emphasis is placed on cleanliness and adequate facilities. Limitation of first-aid care is stressed. Use should not be made of various medications such as local anesthetics and fluorescein except on the request of a physician or through his standing order.

Due to the complexity of present visual requirements in various phases of industry, as to depth perception, color perception, convergence requirements, and measurement of accommodation, any nurse who is to assume

responsibility needs the guidance of the ophthalmologist. Many of the technical features can be mastered by nurses but interpretation should always be controlled by the eye specialist. Owen C. Dickson.

Pacheco-Luna, R. Trachoma in Guatemala. Reprint from proceedings at celebration of 25th anniversary of the foundation of the Association for the Prevention of Blindness in Mexico, 1943, pp. 241-244.

The author recalls some details as to the absence of trachoma in Guatemala, mentioned by him twelve years ago at a meeting of the International League against Trachoma. The only trachomatous persons seen in Guatemala were foreigners, usually Turkish Jews. Such cases have generally been found to progress favorably, have not infected other citizens, and have not spread to native wives or to Guatemala-born children. A similar immunity has been found in other populations. The Guatemala natives live in bad conditions of dirt, poverty, and promiscuity, so that flies and lice are numerous. W. H. Crisp.

Parsons, J. H. Teaching and research in ophthalmology. Brit. Med. Jour., 1944, March 25, p. 430.

This paper begins with an exposition of some basic tenets of medical education—the aim of producing a skilled general practitioner, and the corollary features of emphasis on general principles and training in medical logic, as well as reduced emphasis on some of the weight of factual knowledge which the student must assimilate. The ideal arrangement depends on close affiliation between an eye hospital and a general teaching hospital.

"Basic" ophthalmologic research re-

quires extensive training and knowledge in special fields, and is likely to attract physiologists more than clinical ophthalmologists. It is emphasized that a knowledge of clinical ophthalmology is essential for successful research; and research, in turn, will develop most successfully where the individual is given a free hand, rather than by pursuing a planned research program. Benjamin Milder.

Potts, P. C. Classes for partially-seeing children in schools for the blind. *Outlook for the Blind*, 1944, v. 38, June, p. 151.

Most states have classes organized for partially-seeing pupils. Other states have no such facilities. In the latter states many schools for the blind accept children with vision from 20/200 to 20/70. If the number of such children is large enough, it is better to organize special sight-saving classes. If the number is too small they have to be taught together with blind children. Whereas in the regular public school the guiding principle is to let weak-eyed pupils study as much as possible with normal pupils, in the school for the blind the reverse holds true. Pupils with poor sight should work as little as possible with blind pupils. Some pupils will do better by using their sight, while others will do better when they learn by doing rather than by reading. Fullest use should be made of Talking Book, Victrola, radio, slides, pictures, and models. The teacher should have special training in sight-saving methods and eye hygiene, and he should be familiar with the defect and the amount of vision each pupil has. R. Grunfeld.

Rusalew, Herbert. A blueprint for the higher education of the adult blind.

*Outlook for the Blind*, 1944, v. 38, June, p. 154.

The author points out the need for adaptation of the existing college-level correspondence-courses to the educational requirements of the sightless. An intermediate agency would have to be created, to provide for Braille transcription of the textbooks and assignments, and to expand Talking Book facilities for those who are unable to read Braille, placing textbook and lesson materials on phonograph records. R. Grunfeld.

Sharp, C. G. K. Planning for basic research in ophthalmology. *Brit. Med. Jour.*, 1944, May 20, pp. 697-698.

Looking into the post-war period, the author emphasizes the need for sufficient funds to reduce blindness through research. It is important that this ophthalmic research be organized at this time, and that it be done in close association with the basic sciences, other research units, and clinical facilities. Such research is now being successfully done at the University of Oxford (Ida Mann) and at the Royal College of Surgeons and Royal Eye Hospital (Arnold Sorsby). More such units are needed. £20,000 minimum yearly has been recently appropriated to carry on similar research. It is suggested that those in the services who have outstanding abilities or training in this field be interested in making ophthalmic research their life work after discharge, which it is urged should occur as soon as possible.

Charles A. Bahn.

Stallard, H. B. The eye department in a Middle East general hospital. *Brit. Jour. Ophth.*, 1944, v. 28, June, pp. 261-275.

A survey of the organization and

nature of the work in the eye department of one of the hospitals serving the Eighth Army from the autumn of 1940 to the conclusion of the North African campaign in May, 1943, is presented. Refractions were the main part of the work both during active military operations and in the intervals.

An average of three sets of full clinical notes and two abstracts was kept for each patient. To this hospital were referred especially patients with retained intraocular foreign bodies, retinal detachments, and cases requiring plastic reconstruction of eyelids, sockets, and orbit, as well as patients of neurologic interest with bizarre field defects. The majority of extractions of intraocular foreign bodies were done by the posterior route. This is regarded by the author as the operation of choice for extracting war missiles. Blind patients awaiting transfer to South Africa were also cared for in the hospital. Often they had to wait three or four months before a hospital ship was available.

The following clinical research was carried out. (1) Penicillin drops were used on infected wounds, in the conjunctival sac and in sockets. Bacteria were found to disappear from cultures of the wound and conjunctiva after 48 hours. (2) Cetyl pyridinium bromide was successfully used in the preparation of the field of operation. Nonirritant to the skin and conjunctiva, it is lethal to staphylococci and streptococci outside the body in 1 in 10 million and in serum in 1 in 10 thousand. (3) The value of sulphonamide dusting in wounds of lids and orbit and in primary suture was studied. (4) New methods in plastic operations were tried with success. (5) A technique of extracting intraocular foreign bodies by the posterior route was elaborated

and successfully used in 73 cases. (2 figures, 1 table.)

Edna M. Reynolds.

Sylvester, Lorna. What the home teachers should know about social work. Outlook for the Blind, 1944, v. 38, March, p. 68.

The home teacher should respect personal beliefs and behavior however they may differ from those of the teacher. She should also recognize that people grow in self-respect by doing things for themselves, and gain freedom by discovering their own power. Fear of not having this power will often be expressed as an attempt to be dependent upon another. One case history is given to illustrate these doctrines.

R. Grunfeld.

Theodore, F. H., Johnson, R. M., Miles, N. E., and Bonser, W. H. Causes of impaired vision in recently inducted soldiers. Arch. of Ophth., 1944, v. 31, May, pp. 399-402.

Uncorrectable impaired vision was encountered in 10,532 of 190,012 recently inducted soldiers. This report is the result of a survey taken at Miami Beach, Florida, to discover why the corrected vision of these men was below Army standards (20/40), usually in one eye, or sometimes in both.

It was found that only one fourth of all men with poor vision had organic disease of the eye. In two thirds of the men, trauma resulting from carelessness was the etiologic factor. In the other three fourths, early care of the eyes might have prevented some of the resulting amblyopia, particularly the amblyopia resulting from strabismus and refractive defects.

Questioning revealed that as to almost all of the men with a neglected defect, especially those from large

cities where care was available, the major factor was ignorance or apathy concerning the defect. The authors therefore conclude that education rather than the expansion of existing health facilities is the most essential need. (9 tables.)

R. W. Danielson.

Walker, J. P. S. Ophthalmic surgeon and optician. *Brit. Med. Jour.*, 1944, April 22, p. 560.

The author suggests a plan to correlate the efforts of the ophthalmic surgeon, the optician, the orthoptist, and the ophthalmic nurse. He proposes that all these be registered by the Brit-

ish Governmental agencies after reaching competency, and together form groups of different sizes depending on local conditions. The ophthalmic surgeon would direct and would apparently be responsible for the efforts of the others. Thus the sight-testing optician tests eyes under the supervision and responsibility of the ophthalmic surgeon. This plan the author believes would offer ample employment especially after the war, would avoid existing controversies among those now engaged in care of the eyes, and would give the public better eye-service.

Charles A. Bahn.

## NEWS ITEMS

Edited by DR. DONALD J. LYLE  
904 Carew Tower, Cincinnati 2

News items should reach the editor by the twelfth of the month

### DEATHS

Dr. Milton C. John, Stuttgart, Arkansas, died June 9, 1944, aged 67 years.

Dr. John R. Pollock, Ardmore, Oklahoma, died June 28, 1944, aged 61 years.

Dr. Wilbut F. Reed, Cheboygan, Michigan, died June 30, 1944, aged 93 years.

### MISCELLANEOUS

A postgraduate course in ocular muscles will be given at the Northwestern University Medical School, 303 East Chicago Avenue, Chicago, by Dr. James W. White of New York from December 9th to 16th. Sessions will be held daily from 3 to 6 p.m. and from 7 to 9 p.m.; Sunday from 10 a.m. to 1 p.m. Demonstrations will be held during the day at a convenient time and place for small groups. Registration will be limited. The fee is \$100.00—one-half due with registration, balance due December 9th. The committee in charge consists of Drs. S. J. Meyer, T. D. Allen, and B. Cushman (treasurer), 25 East Washington Street, Chicago 2.

### DIRECTORY OF MEDICAL SPECIALISTS

The biographic data of the first two editions of the Directory of Medical Specialists included only positions (internships, residencies, or assistantships) held during the course of training of men up to the time of their certification by the American Boards, and hospital and medical school staff positions then currently held.

It is desired to extend these data in the third edition to include all formal hospital and medical school appointments, with dates held, even though now resigned, as well as records of all military service including commissions and dates, either in World War I, peace-time in the Reserve forces, or in the present war.

Thus, a chronologically complete sketch of a Diplomate's entire career is to be included in this third edition of the Directory.

Membership or fellowship in national or sectional (not local) special societies, and national general societies with offices held, and dates, in any of these, should be reported.

Membership in recognized international medical societies may be included, but honorary or other membership in foreign medical societies should not be reported.

Reference to the second edition (1942) of the Directory may be made for lists of medical

societies to be included in one's biographic sketch.

Families or secretaries of men absent in military service are asked to complete or correct previous listings or new forms now being mailed to those eligible for inclusion in the Directory. Only those certified by an official American Board can be included, and there is no charge for this listing.

The foregoing notice is published in response to many inquiries, to assist those certified by the American Board who are now engaged in correcting their previous listings, or preparing new sketches for the third edition of the Directory to be published early in 1945.

Communications should be addressed to the Directory of Medical Specialists, 919 North Michigan Avenue, Chicago 11, Illinois.

### SOCIETIES

The thirty-sixth meeting of the Reading, Pennsylvania, Eye, Ear, Nose, and Throat Society was held September 20, 1944. Dr. Lewis R. Wolf, Temple University, spoke on "The surgical treatment of strabismus" and discussed the means of diagnosis and the indication for operation for the various types of squint.

The Southern Medical Association held its thirty-eighth annual meeting in Saint Louis, Missouri, from November 13th to 16th. Beginning Tuesday afternoon, November 14th, and continuing through Thursday afternoon, the programs of the 20 sections of the association were presented. The officers of the Section on Ophthalmology and Otolaryngology were: Dr. W. Raymond McKenzie, Baltimore, chairman; Dr. J. W. Jervy, Jr., Greenville, South Carolina, chairman-elect; Dr. George J. Taquino, New Orleans, vice-chairman; and Dr. Elbyrne G. Gill, Roanoke, Virginia, secretary.

The Research Study Club of Los Angeles will hold its fourteenth annual Mid-winter Postgraduate Clinical Convention in Ophthalmology and Otolaryngology, January 22 to February 2, 1945.

Provided there are at least 50 applicants the American Board of Ophthalmology will conduct an examination in Los Angeles in January, 1945, just before this mid-winter convention. Application should be made promptly to the American Board of Ophthalmology, Cape Cottage, Maine.

Among the guest speakers will be Dr. Cecil S. O'Brien, Iowa City, Iowa; Dr. Kenneth C. Swan, Portland, Oregon; Dr. William S. Crisp, Denver, Colorado; and Dr. Irving B. Lueck, Rochester, New York.

A special course in "Applied anatomy and cadaver surgery of the head and neck" will be held February 2d to 6th, inclusive. Dr. Simon Jesberg will conduct this course in association with Dr. S. A. Crooks.

The fee for the Clinical Course is \$50.00; the fee for the Cadaver Course is \$50.00. Please send application and fee to Dr. Pierre Viole, 1930 Wilshire Boulevard, Los Angeles 5, California.

The seventy-ninth annual session of the Michigan State Medical Society was held at the Civic Auditorium and the Pantlind Hotel, Grand Rapids, from September 27th to 29th. Among the speakers at the convention, which was a postgraduate conference on war medicine, was Dr. Albert D. Ruedemann, Cleveland, who discussed "The protruding eye."

#### PERSONALS

At the luncheon given by this Journal for its directors, staff, and collaborators, on the occasion of the Academy meeting in Chicago, on October 11th, Dr. F. B. Woodruff, as spokesman for the Journal, presented to Dr. William H. Crisp a watch in token of appreciation of his long and loyal service to the Journal. The in-

scription on the watch reads as follows:

William H. Crisp, for outstanding contributions to ophthalmology, 1944.

After September 21st the offices of Dr. Charles A. Bahn will be located at 1026-1028 Maison Blanche Building, New Orleans 16, Louisiana.

The sixteenth annual Arthur Dean Bevan Lecture was given by Dr. Howard C. Naffziger, professor of surgery, University of California Medical School on October 6th before the Chicago Surgical Society. The title of the lecture was "Exophthalmos and the thyroid: Experiences with major surgery of the orbit."

Dr. A. D. Ruedemann, chief of the ophthalmological department of the Cleveland Clinic, was the guest speaker at the September dinner meeting of the Cleveland Ophthalmological Club. The subject of his lecture was "The value of Beta radiation in lesions of the eye" and was illustrated with many beautiful lantern slides.

The tonometer checking station at the Illinois Eye and Ear Infirmary is making a collection of historic tonometers. Will any reader who has a tonometer that would fit into this collection donate it for display, for which credit will be shown? Any descriptive letters of such tonometers will be appreciated.

Harry S. Gradle, M.D.,  
58 E. Washington Street,  
Chicago 2, Illinois.

## OBSTRUCTION OF THE CENTRAL RETINAL VEIN\*

## A CLINICO-HISTOPATHOLOGIC ANALYSIS

BERTHA A. KLIEN, M.D.

*Chicago*

During the past 40 years, the histopathology of obstruction of the central retinal vein has been discussed by many writers who have confined their publications to the histologic findings, of which they have presented a great and sufficient variety. The present study of a series of eyes lost in the course of venous occlusion introduces an attempt to correlate clinical with histopathologic data, making use especially of the newer knowledge, acquired during recent years, of the cardiovascular and hypertensive diseases, which often play an important role in the pathogenesis of the obstruction. The amount of pertinent histologic material in any laboratory is thereby limited, but such studies may yield eventually a better comprehension and clearer interpretation of the factors involved in the mechanism of venous occlusion, and more individualized and effective therapeutic methods.

The mechanisms of primary occlusion of the central vein already recognized from a combined clinical and histologic knowledge, can be classified into four types:

1. Occlusion by compression of the vein by structures external to it, through advancing sclerosis of the surrounding tissues, or through growth of tumor me-

tastasis into the optic nerve, or slow expansion of benign tumors such as angiomas, within the optic nerve. This may occur either with or without secondary thrombus formation.

2. Occlusion by thrombosis secondary to inflammatory disease of the venous wall.

3. Occlusion by primary thrombus formation in blood dyscrasias.

4. Occlusion by the stagnation thrombosis following sudden reduction of the arterial-blood volume of the retina. From a purely histopathologic point of view the pathogenesis of only the first two types can be demonstrated beyond doubt.

The material presented here consists of two groups of eyes:

1. Twenty-four eyes which were lost because of secondary glaucoma consecutive to a primary obstruction of the central vein of the retina.

2. A small group of three eyes removed for various other indications, in which the histologic findings pointed to an imminent occlusion of the central vein. As the time elapsing between occlusion and enucleation is of decisive influence regarding the interpretation of primary essential and of secondary findings, the material of the first group is subdivided into:

- (a) Eyes in which both occlusion of the central vein and onset of glaucoma were of recent origin, having occurred within six months of enucleation.

\* From the Laboratory of Ophthalmic Pathology, Presbyterian Hospital. Read before the Chicago Ophthalmological Society, March 20, 1944.



(b) Those in which the obstruction of the vein occurred by more than six months to several years before the secondary glaucoma of recent development.

(c) Those in which occlusion as well as glaucoma are at least one year old. Groups b and c are excluded from the selection of case reports presented herewith, since the long time interval obscured the pathology of the primary occlusion. In many of the cases presented, there was a careful study of the fundus of the other eye at the time of the vascular accident, or of both fundi at a previous time and again at the time of enucleation.

The major portion of any histologic material dealing with venous occlusion consists of specimens illustrating the first and perhaps most frequent type of occlusion, that on the basis of sclerotic processes in and around the vein. In its essentials the histologic picture of this type of occlusion has been well defined by the investigations of Harms,<sup>1</sup> Verhoeff,<sup>2</sup> Scheerer,<sup>3</sup> and Coats.<sup>4</sup> The structures participating in this chronic sclerotic process are the central artery, the central vein itself, and central connective-tissue strand, and often glial remnants of the primitive epithelial papilla, which usually rest directly on the venous wall at or near its bifurcation, and which are known as the glial meniscus. The intralaminar portion of the vein has been demonstrated to be the invariable place of occlusion by such sclerotic processes.

The following series of illustrations will show, however, that the histologic picture in individual instances varies greatly with the predominance of sclerosis in one or the other of the aforementioned structures and with the coexistence of secondary features such as hemorrhagic imbibition, formation of a collateral circulation, and preretinal or pre-papillary connective tissue. A knowledge of the clinical status of the patient is often

of great value in accounting for the predominance of one or another of the primary or secondary findings.

Cross sections of the optic nerve were made in some of these eyes for the special purpose of studying the central vessels. In the others in which there were only the usual meridional sections, profiles of the central vein were made to illustrate its topography. These profiles, vertical or horizontal, depending upon the plane in which the bulb was sectioned, are made by drawing serial sections one over the other, the measurements in each section being obtained by use of an ocular micrometer after the method extensively used by Salzmann.<sup>5</sup>

#### CASE REPORTS

*Case 1.* M. M., aged 63 years, under observation for two years because of a mild diabetes and advanced essential hypertension (220/110), had a marked retinal arteriolar and arteriosclerosis together with an arteriosclerotic retinopathy which had reduced the visual acuity of each eye to 8/200. Especially noteworthy in the left eye was a slight narrowing of the retinal arterial vascular tree.

Some 15 weeks before its enucleation, a massive hemorrhage into the vitreous of the left eye obscured the fundus completely and reduced vision to bare light perception; within two weeks there was a rise of tension to 60 mm. Hg (Schiötz), which returned to normal only temporarily following an Elliot trephining operation. The clinical diagnosis was obstruction of the central vein of the retina, followed by secondary glaucoma.

The histologic examination of the posterior segment of the vertically sectioned bulb revealed moderate hemorrhagic imbibition of the retina in addition to the massive vitreous hemorrhage, and a large number of new-formed, wide, and thin-

walled preretinal veins and capillaries.\* There were moderate retrodisplacement of the lamina cribrosa, more marked below than above, and considerable atrophy of the optic nerve.

The central artery was seen to be a wide, rigid tube filled with endothelial and subendothelial proliferation and some

of the lamina cribrosa the vein became narrower, being encroached upon from below by a fibrous triangle which appeared to be part of the central connective-tissue strand. The superior wall of the vein was thickened throughout the intralaminar portion. Beginning at the junction of the superior and inferior



Fig. 1 (Klien). O, obliterating endarteritis, case 1.

elastic lamellation. These endarteritic lesions extended into some of the papillary branches (fig. 1). There was marked thickening of the media and adventitia of some of the retinal arterioles, but no hyalinization (fig. 2).

The histopathologic findings within the optic nerve and the central vein and its branches are illustrated in the vertical profile (fig. 3). There was a marked engorgement of the superior and inferior papillary veins, which united in the prelaminar region to form the central vein. A well-developed glial meniscus rested upon the bifurcation. Toward the middle

papillary veins and extending backward to almost the posterior level of the lamina cribrosa the temporal and nasal walls of the central vein were connected by a solid mass which appeared to consist almost exclusively of endothelial cells. There was only a narrow column of blood at the level of this mass connecting the retrolaminar portion of the vein and the superior papillary vein. The narrow passage into the inferior papillary vein was completely blocked by a homogeneous coagulum having the appearance of a recent thrombus, secondary to the old and extensive endophlebitis. These intravenous lesions, which were densest and broadest at the temporal wall of the vein—that is, the wall opposite the artery—could be

\* See illustrations in Klien, B. A. Retinitis proliferans. *Amer. Jour. Ophth.*, 1938, v. 20, p. 434.

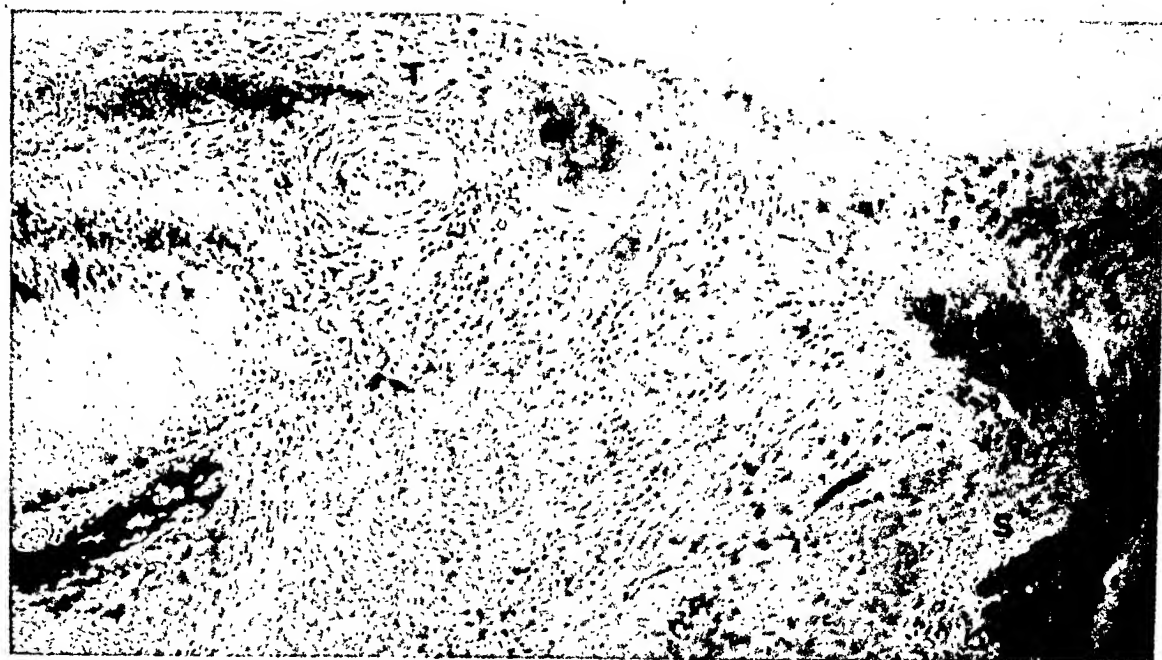


Fig. 2 (Klien). T, arterio-venous crossing, case 1; marked thickening of media and adventitia of artery. S, fibrosed central connective tissue strand; V, central vein with endothelial proliferations.

followed through seven consecutive sections, each 20 microns in thickness. Thus the horizontal diameter of the central vein within the lamina was only moderately reduced to about 140 microns, as compared to the normal 190-200 microns

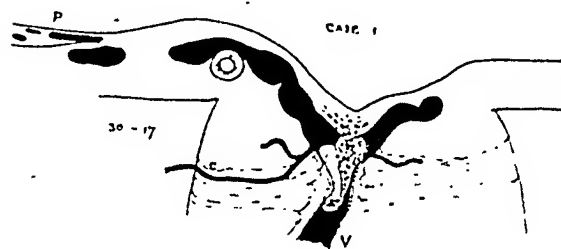


Fig. 3 (Klien). Vertical profile of central vein in case 1. P, retinitis proliferans; V, central vein; C, collaterals.

(Hertel<sup>6</sup>). A few small collateral venous branches could be traced through the anterior lamina toward the ciliary system.

The clinically observed narrowing of the retinal arterial vascular tree in this eye only, which was not spastic in character, pointed to reduction of the blood column in the central artery by sclerotic changes which formed the basis, after the

venous occlusion, for the rapidly obliterating endarteritic process.

*Case 2.* S. M., a woman, aged 61 years, whose blood pressure was normal (140/94), had had severe diabetes mellitus for many years, but no ocular complaints until the sudden loss of vision of the right eye 12 weeks prior to its enucleation. The loss of vision was followed within a few days by severe pain in this eye and an increase of tension to 77 mm. Hg (Schiotz), which was not reduced below 50 mm. by miotics and a paracentesis. The right fundus was obscured by hemorrhage into the vitreous. The left eye was normal. The clinical diagnosis was secondary glaucoma following obstruction of the central retinal vein.

The histologic examination of the posterior segment of the horizontally sectioned bulb revealed an extensive vitreous hemorrhage, moderate hemorrhagic imbibition of the retina, and several large preretinal hemorrhages. There were several large, thin-walled preretinal veins directly connected with dilated veins of the

nasal portion of the retina. A plaque of prepapillary connective tissue also contained large new-formed vessels. There was considerable atrophy of the optic papilla but only slight retrodisplacement of the cribrous plate.

The lumen of the central artery (185 microns) was widely gaping, a sign usually pointing to rigidity of the arterial walls. The measurements of the thickness of the arterial wall were slightly increased (32 microns as compared to the normal 20 to 26), mainly due to a thickening of the adventitia. The latter and the central connective-tissue strand were poor in elastic fibers and well set apart from the surrounding tissues by increased fibrosis. Some of the retinal arteries showed a patchy fibrosis such as is often seen following healed atheromatous lesions, whereas other branches appeared normal



Fig. 4 (Klien). Atheromatous lesion in retinal vessel, case 2 (hematoxylin-eosin stain).

(fig. 4). The intralaminar space containing the central vein was considerably reduced, the venous walls were thickened throughout the intralaminar course and for a short stretch behind the lamina. A thick plaque of endothelial cells projected from the temporal wall of the vein, be-

ginning at a sharp bend near the prelaminar junction of the papillary veins, leaving space only for a threadlike blood column along the nasal wall of the vein. From this plaque backward there extend-

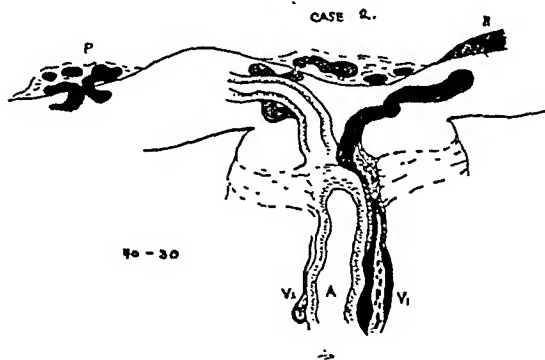


Fig. 5 (Klien). Horizontal profile of central vessels in case 2. A, central artery; V<sub>1</sub>, central vein; H, preretinal hemorrhage; P, retinitis proliferans.

ed a band of varying width, also consisting mainly of endothelial cells, which crossed the free lumen of the vein and was attached to the opposite venous wall farther back (fig. 5).

Intravenous endothelial bands such as these are interpreted by some authors to be recanalization of a thrombus, but Verhoeff has shown that they are detached endothelium where small tributary veins have forced their blood behind degenerated endothelium, and thus formed a new channel in the manner of a dissecting aneurysm.

The essential features of cases 1 and 2 are similar. In both, the extensive formation of thin-walled wide preretinal collaterals pointed to impairment of the venous circulation for some time before the clinically diagnosed vascular accident. While in both, the intralaminar venous aperture was narrowed by a sclerotic artery, fibrosis of the central connective-tissue strand, and thickening of the venous walls, the main obstruction of the vein arose from endothelial proliferation anterior to this external encroachment upon

the vein. Hence this endothelial hyperplasia, which was most pronounced within the anterior lamina near the junction of the papillary veins, gradually tapering off within the posterior lamina, did not seem to be a secondary irritative proliferation due to venous collapse or excessive com-

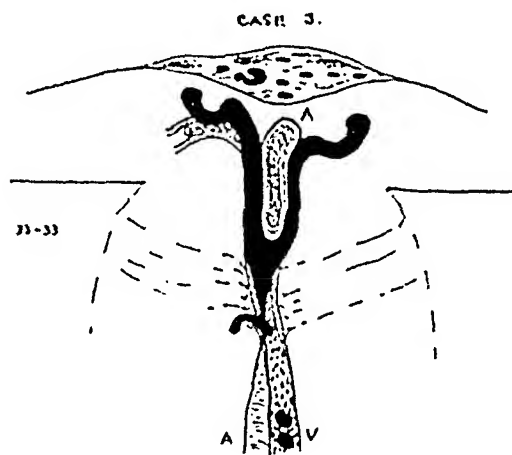


Fig. 6 (Klien). Vertical profile of central vein in case 3. A, V, as in figure 5.

pression, but gave the impression of a co-existent phlebosclerosis on the basis of an endo- and mesophlebitis.

The following two eyes present somewhat different aspects.

*Case 3. B. R.*, a man, aged 54 years, had an essential hypertension (average blood pressure 170/110). Seven weeks prior to enucleation of the left eye, its vision suddenly was reduced to light perception, followed within a few days by pain and redness. The fundus was obscured by vitreous hemorrhage and the tension was elevated to 80 mm. Hg (Schiotz). After an Elliot trephining operation failed to reduce the tension, the eye was enucleated, on the basis of a clinical diagnosis of occlusion of the central retinal vein. The right eye was normal in every respect, with a vision of 1.5.

The histologic examination of the posterior segment of the vertically sectioned bulb revealed moderate diffuse vitreous

hemorrhage and extensive preretinal and prepapillary hemorrhages in the process of organization into massive plaques of prepapillary connective tissue. There was still some edema of the optic nerve with incipient atrophy, and irregular, moderate retrodisplacement of the cribriform plate. The measurements of the central artery (CA) *in toto* were slightly increased in the intralaminar portion. The adventitia was normal, the muscularis was slightly, and the internal elastic membrane markedly, thickened and there was evidence of a longitudinal shrinkage of the artery, the elastica interna being markedly undulated and fixed in this position by smooth plaques of proliferated endothelium. Thus the lumen of the artery was considerably constricted. It was filled almost completely with endothelial and sub-endothelial proliferation which extended for a short way into the papillary branches. There was a marked thickening of the media and adventitia of all the retinal arteries and arterioles, but no hyalinization. The central connective-tissue strand (CCTS) was delicate, with an abundance of elastic fibers.

The central vein (CV) arose at the junction in the prelaminar region of the two papillary veins. Its walls were thick and rich in cells throughout the intralaminar course. Within the posterior half of the lamina the lumen was narrowed acutely by endothelial proliferation which seemed to fill it entirely at the posterior level of the lamina (fig. 6, vertical profile). Farther back an irregular lumen reappeared between the endothelial plaques. There was slight round-cell infiltration of the venous walls in the intra- and retrolaminar course. The horizontal diameter of the venous lumen within the posterior half of the lamina was even more reduced than the vertical, being about 80 microns; that is, less than half of the normal. Cross sections through the

optic nerve about 1 mm. behind the lamina still showed marked elastic lamellation of the internal elastic membrane of the artery, and a thickened muscularis. The venous lumen at this level was well filled with blood by tributaries from the septal system, but there was still an asymmetrical thickening of the endothelial and subendothelial layers.

*Case 4.* S. O., a man, aged 54 years, had a moderate arterial hypertension (158/100) of undetermined type. When first seen after one year of failing vision, the left eye had been painful for six months, was glaucomatous, with a tension of 71 mm. Hg (Schiötz), and had a beginning serpiginous ulcer.

Repeated paracentesis while the corneal ulcer was healing, and a later iridectomy, reduced the tension only temporarily. At the time of enucleation of the left eye, the tentative diagnosis was secondary glaucoma following a vascular accident. The right eye was normal in every respect, with a vision of 1.0.

Histologic examination of the posterior segment of the horizontally sectioned bulb showed marked hemorrhagic imbibition of the retina and infiltration with pigment-laden phagocytes. There was a slight retrodisplacement of the lamina cribrosa but no optic atrophy. Throughout the nasal half of the optic nerve there were convolutions of wide, well-filled veins, representing from all appearances an efficient collateral circulation whose place of exit from the optic nerve could not, however, be determined definitely, for the sections were at a right angle to the course of these vessels. In the prelaminar region there were also a number of capillary spaces which appeared to be just in the process of being opened up.

The total diameter of the intralaminar portion of the central artery was 240 microns; that is, only slightly more than

normal. The outer part of its wall, adventitia plus media, was broader than normal, mostly owing to thickening of the adventitia, as shown by van Gieson stains. The entire intima was artificially detached and retracted, lying in the prelaminar lumen of the artery. The retinal arteries

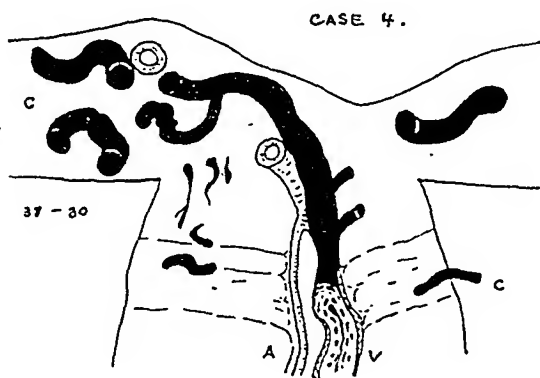


Fig. 7 (Klien). Horizontal profile of central vessels in case 4. C, collaterals.

appeared normal. The central connective-tissue strand was not thickened as a whole, but a cuneiform fibrous mass projected between central artery and vein from below.

The central vein, shown in horizontal profile (fig. 7), made a sharp bend at about the center of the lamina, where a considerable thickening of its walls began. From this place back to the cut surface of the nerve the lumen of the vein was completely filled with an old fibrous mass which was lined with endothelium and contained in its posterior part a slitlike blood column. Proximal to the sharp intralaminar bend the total vertical diameter of the vein was only about 65 microns, a third of the normal.

Remarkable in this case were the abundant wide collaterals, which coursed through normal nerve tissue, and therefore have to be considered as dilated preformed venous or capillary channels. Remarkable also was the absence of optic atrophy, considering that the duration of the secondary glaucoma was at least six



months. This finding supports the view that the degree of optic atrophy following an obstruction of the central vein depends upon the early efficiency of a collateral circulation, in the presence of which secondary glaucoma may exist for a long time without inducing extensive destruction of nervous elements. Lacking such

the otherwise normal central connective-tissue strand associated with it, added to the embarrassment of the vein in this place.

*Case 5.* See Klien, "Anticoagulant therapy in occlusion of central vein of retina," *Amer. Jour Ophth.*, 1943, v. 29, p. 701.

*Case 6.* F. M., a man, aged 71 years, suffering from mild arteriosclerotic hypertension (160/100; after therapy, 130/80), complained of overnight loss of vision of the right eye nine weeks prior to enucleation. The visual disturbance (bare light perception with faulty projection) was followed within four weeks by a rise of intraocular tension to 55 mm. Hg (Schiotz) which was reduced temporarily to normal by an Elliot trephining operation. Fundus details were never visible in the right eye. The left eye had a second-degree retinal angiosclerosis, and its visual acuity was 1.0.

Histologically there was a marked diffuse hemorrhagic imbibition of the retina, some edema of the optic nervehead with considerable rarefaction of the nerve fibers, and incipient retrodisplacement of the lamina cribrosa. There was a high degree of sclerosis of the CCTS and the central artery and its immediate branches, while many of the smaller retinal arteries appeared normal. A vertical profile (fig. 8) illustrates the findings in the papillary and central veins. The central vein had three papillary tributaries, two of which were collapsed before the junction. There was extreme narrowing of the central vein in its intralaminar course, and endothelial plaques and strands could be followed through it, beginning near the junction and ending a short stretch behind the lamina. The adventitia of the two partly collapsed papillary veins and the central vein was quite thick. The place of collapse of the veins seemed to be where they

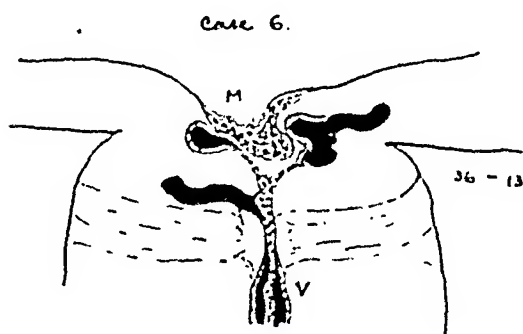


Fig. 8 (Klien). Vertical profile of central vein in case 6. M, glial meniscus.

collaterals optic atrophy seems to develop rapidly, as some of the cases presented here show, due to a combination of malnutrition and toxic action, to which only much later the destructive influence of increased intraocular pressure is added.

In both of these cases the pathologic findings responsible for the venous occlusion were limited to the posterior half of the lamina. In keeping with the younger age of the patients there was no fibrosis of the central connective-tissue strand. The vascular sclerosis dominated the picture with a markedly sclerotic artery encroaching upon the vein and a coexisting phlebosclerosis, which had led to considerable thickening of the adventitia and to occluding endothelial proliferation. As the lumen of the vein was considerably narrowed in both cases there is the possibility that some of the more recent endothelial proliferation was secondary to compression from which contact of the inner venous surfaces resulted. In case 4 an anomalous intralaminar course of the vein, and an anomalous configuration of



coursed between the bifurcating sclerosed arterial branches. An unusually large glial meniscus penetrated deeply between these two venous branches. There were no visible collaterals.

In this case the picture of obstruction of the central vein was obviously produced by simultaneous branch occlusion of the superior and inferior papillary veins through marked sclerosis of the first branches of the central artery and an unfavorable topographic arrangement of these arteries and veins, although there was also extreme narrowing of the intralaminar central vein. A third papillary branch had remained patent and its blood stream had undermined the venous endothelium proximal to the collapse of the two other branches, in the nature of a dissecting aneurysm.

In the following two eyes which came from patients with malignant hypertension, the optic nerves are demonstrated in cross sections.

*Case 7.* C. B., a woman, aged 41 years, who had a diagnosis of early malignant hypertension, average blood pressure 235/125, had some intermittent obscurations followed by complete loss of the vision of the left eye six months prior to its enucleation. There were some hemorrhages into the vitreous and indistinctly visible large retinal extravasations. The onset of secondary glaucoma, with a tension of 90 mm. Hg (Schiötz), occurred four months before enucleation, and tension remained normal for several weeks after a trephining operation.

In the right fundus there was marked generalized spastic contraction of the entire retinal arterial vascular tree, and a marked venous displacement at the arteriovenous crossings. A few of the larger arterioles had irregularities of caliber which were thought to be possibly spastic

as there was no visible retinal angiosclerosis. There was no retinopathy nor edema of the optic disc. Vision of the right eye was 1.5.

Cross sections through the optic nerve at the posterior level of the lamina cribrosa showed a normal CCTS, an oval

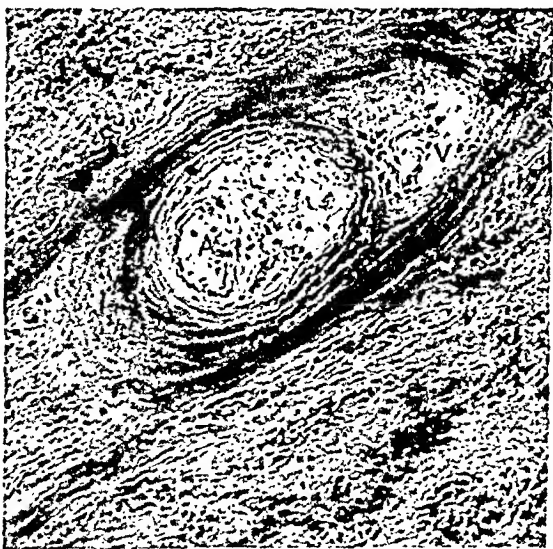


Fig. 9 (Klien). Cross section through central vessels in case 7 at posterior level of lamina cribrosa (van Gieson stain).

cross section of the central artery, which exhibited marked thickening of the tunica intima. Muscularis and adventitia appeared normal. There was a triangular cross section of the central vein, the lumen of which appeared somewhat collapsed but not compressed and was extremely narrowed by subendothelial proliferation which arose mainly at the three pointed, collapsed angles of the triangular aperture (fig. 9). There was no appreciable thickening of the venous walls.

Cross sections through the anterior lamina cribrosa at the level of the venous junction showed extreme venous congestion but no endo- or mesophlebitis.

There was a marked thickening and hyalinization of the retinal arterioles (fig. 10).

*Case 8.* M. N., a woman, aged 56 years,



Fig. 10 (Klien). Hyaline degeneration of retinal artery, case 7 (van Gieson stain).

who had malignant hypertension (blood pressure varying from 300/140 to 240/92), suddenly lost the vision of the right eye six months prior to its enucleation. Obstruction of the central retinal vein was diagnosed, and after several months was followed by a rise of tension to 97 mm. Hg (Schiötz).

The fundus of the left eye showed excessive generalized narrowing of the retinal arteries and arterioles, and incipient arteriolar sclerosis.

Cross sections through the optic nerve at the posterior level of the lamina cribrosa (fig. 11) showed a normal CCTS and an almost collapsed central artery whose walls were only slightly thickened by hyperplasia of the elastica interna. The cross section of the central vein was oval and completely occluded by a fibrous plug. The lumen of the central vein remained collapsed throughout its retrolaminar course to the place of exit from the nerve 4.0 mm. behind the eyeball, and throughout this course there was considerable thickening of the walls by a subendothelial proliferation of connective tissue.

There was marked hyalinization of the retinal arterioles, the lumina of some of

which were reduced to the diameter of an erythrocyte. Many of the larger retinal veins showed endothelial proliferation.

In both cases (7 and 8) there was a striking discrepancy in the amount of sclerosis of the CA and that of the retinal arterioles. Sclerosis of the CA consisted merely in hypertrophy of the elastica interna whereas the retinal arterioles showed marked hyalinization. The central arteries did not show the rigid circular cross sections that were seen in the eyes of patients with late essential hypertension or arteriosclerotic disease, and thus did not encroach upon the central vein. In both cases the CCTS was normal.

The central veins were not compressed in their intralaminar course. It cannot be definitely decided at this stage whether the fibrous plug which completely occluded the venous lumen in case 8 and which contained also endothelial cells represents the end result of obliterating endophlebitis or the organization products of a thrombus. The marked pre- and retrolaminar phlebosclerosis and the incipient vascular sclerosis observed in addition to the spastic contraction in the

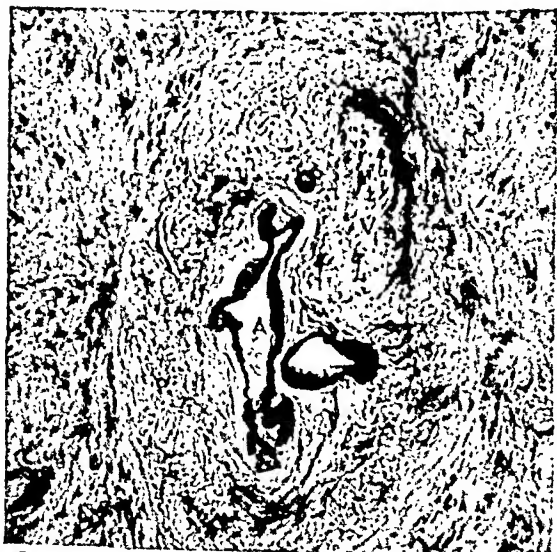


Fig. 11 (Klien). Cross section through central vessels in case 8 at posterior level of lamina cribrosa (Verhoeff's elastica stain).

fundus of the other eye seems to suggest a large element of primary phlebosclerosis in the pathogenesis of the venous occlusion in this eye. Case 7, on the other hand, presents the possibility of being the end result of a stagnation thrombosis, the requisites for which were given; that is, an early stage of a spastic type of hypertension, marked spastic contraction of the retinal arteries, and absence of advanced organic lesions as observed in the other eye. There was no pre- nor intralaminar phlebosclerosis.

The remaining cases of recent occlusion of the central vein are briefly as follows:

*Case 9.* C. H., a man, aged 32 years, had syphilis, left maxillary sinusitis, and normal blood pressure. Vision of the left eye was lost six months prior to enucleation, and there was a rise of intraocular pressure at some unknown time between the loss of vision and enucleation. Extensive retinal hemorrhages were dimly visible. The right eye was entirely normal. Histologic findings: Cross sections through the optic nerve in the anterior lamina cribrosa showed proliferating endophlebitis in one of the papillary veins. CA and retinal arteries were normal; retinal veins showed marked thickening of adventitia. The optic nerve had been cut too short for sections through the posterior lamina cribrosa.

*Case 10.* J. M. B., a man, aged 57 years, who had essential hypertension (blood pressure 200/105), lost the vision of the right eye five months before enucleation, secondary glaucoma following within four weeks. There was only a dull fundus reflex. The left eye was normal in every respect. Histologic findings: Proliferating endophlebitis in the central vein within the posterior lamina and retrolaminar

course. The CCTS was normal; there was marked subendothelial and endothelial proliferation in the CA; thickening of the media and adventitia of the retinal arteries.

*Case 11.* X. H., a man, aged 72 years, two months prior to enucleation lost the vision of the left eye after two years of intermittent visual obscurations. Secondary glaucoma followed the loss of vision within a few days. The right eye was normal. Histologic findings: Occlusion of the CV by endothelial and subendothelial proliferation in the region of the posterior lamina, marked thickening of the CCTS, and adventitia of the CA. Retinal arteries were partly normal, partly showed fibrosis of walls as after atheroma.

Of the secondary findings in eyes with venous occlusion, the various types of collaterals are of special interest, as illustrated in the following cases:

*Case 12.* T. S., a woman, aged 68 years, who had an arteriosclerotic hypertension (blood pressure 180/100), suddenly lost the vision of the left eye two years prior to its enucleation. The horizontal profile of the optic nerve and central vessels (fig. 12) illustrates the complete obliteration of the CV through its intralaminar course and collaterals as follows: two on the temporal side, one of which formed a connection of papillary with choroidal veins or capillaries, the other with some of the veins in the subdural space. On the nasal side a wide vein took an extremely tortuous course through the lamina cribrosa and backward through the trunk of the optic nerve. It could not be determined whether it joined the central vein farther back or entered the subdural space.

The importance of more or less efficient collateral formation in the clinical

outcome of venous occlusion is illustrated in the three following clinical cases.

*Case 13.* X. C., a man, aged 46 years, who had arterial hypertension, cardiac hypertrophy, and insufficiency, albumen, hyaline and granular casts in the urine,

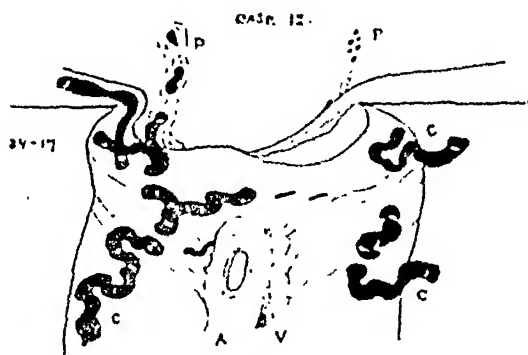


Fig. 12 (Klien). Horizontal profile of central vessels, case 12. C, collaterals.

gave the history of sudden bilateral diminution of vision eight years previously. Vision of the right eye recovered to 1.0, while that of the left eye remained poor: only 0.1, with a small central scotoma. The fundus of the left eye (fig. 13) revealed a normal optic disc, moderate generalized contraction of the retinal arterial vascular tree, and a striking course of some of the veins. Two large veins disappeared into the deeper layers near the superior margins of the optic disc after having been formed by confluence of tortuous malformed branches, one of them representing the inferior retinal vein. There was an area of faint pigmentary disturbance in the macula. The diagnosis of old, repaired occlusion of the central retinal vein was made. The history of bilateral sudden diminution of vision in a hypertensive patient is suggestive of a spastic origin, although no definite conclusion can be reached after the lapse of eight years.

*Case 14.* S. Z., a man, aged 49 years, who had essential hypertension (average

blood pressure 177/118) and coronary disease, five years previously had noted painless failure of vision of the right eye to 10/200 with a central scotoma. The left eye had normal vision (1.2). The fundus of the right eye (fig. 14) showed a normal optic disc, a macular lesion consisting of ill-defined yellowish areas such as are often caused by glial retinal scars after extensive hemorrhages, and three anomalous venous channels, one in the upper half and two in the lower half of the optic nerve, of the appearance of optico-ciliary veins. The diagnosis of old, repaired obstruction of the central retinal vein was made.

An incidentally discovered anastomosis between retinal and choroidal veins is shown in fig. 15. It is the fundus of the right eye of a 64-year-old man with a myopia of 12 diopters and vision of 0.1 in this eye. Owing to the extensive peripapillary myopic atrophy of the pigment epithelium the place of transition of a very tortuous, perhaps new-formed, venous branch from the inferior retinal vein into a choroidal vein of extremely large caliber could be observed directly.



Fig. 13 (Klien). Fundus of left eye in case 13; eight-year-old repaired obstruction of central retinal vein.

There was an area of pigmentary disturbance in the macula.

It is impossible to decide in these cases which part of the collateral circulation consisted of preformed channels and which part of new-formed vessels. In each of them the collateral pathways appeared efficient. The visual disturbance appeared to be due to a macular lesion, which may have developed after extensive hemorrhages.

The following three cases are of special interest, inasmuch as they did not



Fig. 14 (Klien). Fundus of right eye in case 14. Five-year-old, repaired obstruction of central retinal vein.

present clinical manifestations of venous obstruction yet histologically showed conditions of the central vein almost identical with those found in cases of clinical occlusion, but less pronounced.

**Case 15.** E. C., a woman, aged 65 years, who had mild arteriosclerotic hypertension (blood pressure 154/88), and a moderate diabetes mellitus for many years, developed an acute glaucoma of the right eye three weeks prior to enucleation of this eye. There was an advanced rubeosis iridis of the right eye and an incipient

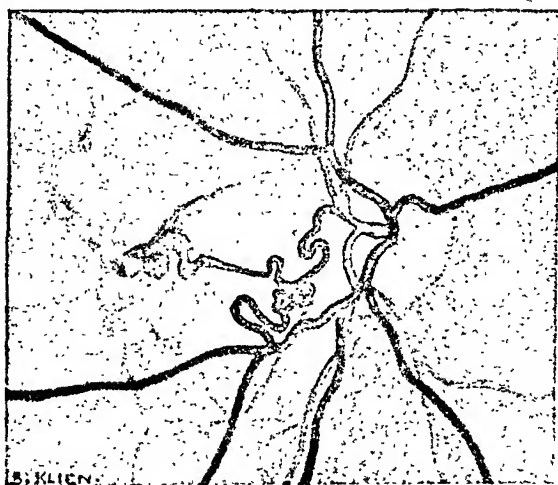


Fig. 15 (Klien). Clinically visible chorioretinal venous anastomosis.

rubeosis with normal intraocular pressure of the left eye. For the previous three years there had been gradual failure of vision of both eyes due to retinopathy.

Histologically there was moderate edema of the nervehead and an incipient rarefaction of the nerve fibers. The horizontal profile (fig. 16) summarizes the histopathologic findings in the central vein, which was moderately narrowed throughout its intralaminar course. Considerable thickening of its adventitia began within the posterior half of the lamina and extended for a short stretch backward. At

CASE 15.

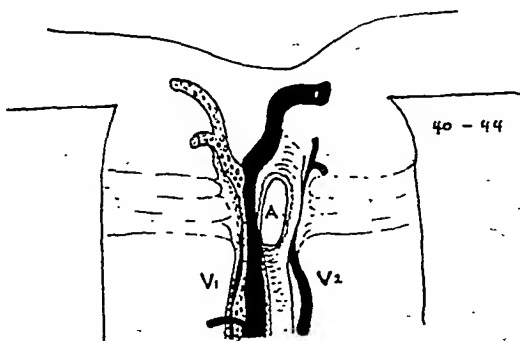


Fig. 16 (Klien). Horizontal profile of central vessels in case 15.

the prelaminar junction of the two papillary veins there was marked endothelial proliferation and bands of loose endo-

thelium could be followed through the intralaminar to the retrolaminar lumen of the vein, where they fused with the venous wall again. The temporal papil-

of undetermined origin, had frequent attacks in the left eye of increased intraocular pressure due to subluxation of the lens. At the time of enucleation the tension was 80 mm. Hg (Schiötz) and, while the fundus was not clearly visible, there was no apparent retinal nor vascular pathologic change.

The histologic examination revealed an almost complete optic atrophy with some retrodisplacement of the lamina cribrosa. The central vessels are shown in the horizontal profile (fig. 17) and the microphotograph (fig. 18). There was extreme

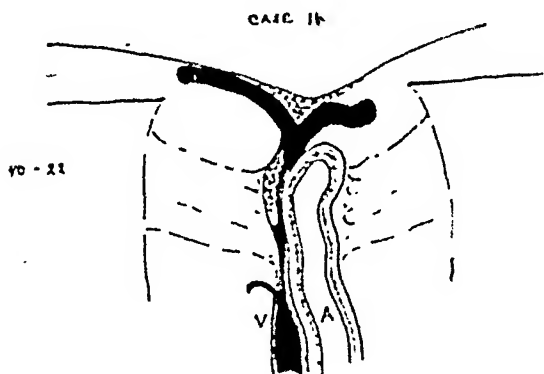


Fig. 17 (Klien). Horizontal profile of central vessels in case 16.

lary vein appeared occluded or collapsed but complete lack of massive retinal extravasations indicate that there was not an actually complete occlusion of this branch.

*Case 16.* J. K., a man, aged 70 years, who had a moderate arterial hypertension

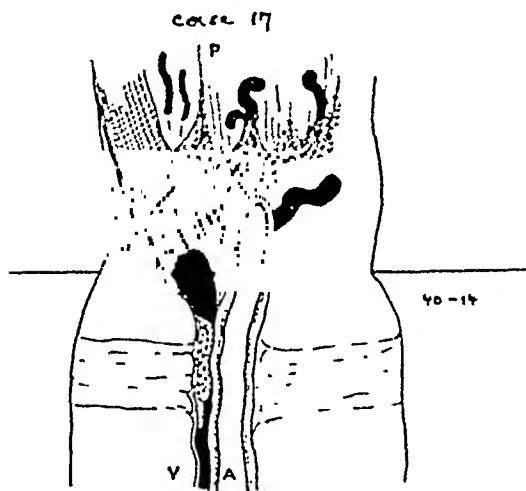


Fig. 19 (Klien). Horizontal profile of central vessels in case 17. H, hemorrhage; P, retinitis proliferans.



Fig. 18 (Klien). Photomicrograph of central vessels in case 16 (hematoxylin-eosin stain).

narrowing of the CV throughout its intralaminar course due to a fibrosed CCTS, marked sclerosis of the CA, and considerable thickening of the adventitia of the vein itself. Plaques of endothelial proliferation partly filled the venous lumen from the junction of the papillary veins backward through the anterior half of the lamina.

*Case 17.* T. F., a woman, aged 62 years, who had had arteriosclerotic hypertension (blood pressure 170/92) and diabetes mellitus of moderate degree for many years, had bilateral failing vision due to



an extensive retinopathy, retinitis proliferans, and, during the previous year, secondary retinal detachment. One week prior to enucleation of the left eye there was an acute rise of intraocular pressure which was not reduced by an Elliot trephining operation. This eye had an incipient rubeosis iridis.

The CV is pictured in a horizontal profile (fig. 19). While there was less narrowing of the lumen of the CV during its intralaminar course than in the two previous cases there was marked endothelial proliferation in the place which appears to be the site of predilection for it, judging from the frequency with which it occurred there in this series; that is, the anterior portion of the lamina cribrosa just proximal to the junction of the papillary veins. It is possible that the extensive retinitis proliferans was due to this type of venous disease.

#### CONCLUSIONS

1. Primary phlebosclerosis in the form of endo- and mesophlebitis plays a greater role than was heretofore supposed in the pathogenesis of venous occlusion, especially in those cases in which the occlusion is not due to senescence of the tissues alone, but to conditions accompanying systemic disorders.

2. The site of the most extensive proliferative endophlebitis is frequently the anterior lamina cribrosa or even the prelaminar region near the junction of the papillary veins, and is almost always associated with a marked narrowing of the vein in the posterior lamina due to mesophlebitis and encroachment upon the vein by sclerotic neighboring structures. Coexistence of these two findings suggests a partly mechanical origin of these endothelial proliferations, perhaps by vortex formations in the blood stream at the venous junction due to narrowing of the venous aperture farther back. A requisite

for the ensuing endothelial proliferation would be a lack of normal resistance, as may happen in systemic diseases, and also in extreme senility.

3. Advanced age in patients without systemic disease and with normal blood pressure most often produces the well-known picture of obstruction in the posterior lamina, in which the final event consists in secondary, irritative endothelial proliferation due to extreme compression at the angles of a semilunar aperture.

4. In preëxisting arterial disease of the retina, venous occlusion and its consequences of stagnation, retrograde slowing of the blood stream, and the like, may bring about occlusion of the central artery in a relatively short time. The influence of venous occlusion upon the retinal arterial vascular tree, even without preëxisting arterial disease, can be demonstrated in the rare instances of intermittent venous occlusion in one eye, where it produces a unilateral retinal angiosclerosis in the eye with the repeated, even if short-lived, attacks of venous obstruction. It has been shown that an irritation of the inner surface of an artery or vein by a thrombus or by an endarteritic or endophlebitic process causes a reflex vasoconstriction of all the arteries in the corresponding area (R. Leriche<sup>7</sup>). Knowledge of this fact should be an added incentive to the prompt employment of therapy, especially the anticoagulants and antispasmodics.

5. The rapidity and efficiency with which collaterals develop, depend partly upon preëxisting channels, partly upon the rate at which the obstruction in the central vein develops. Thus in very gradual obstruction compensatory collaterals may be established before venous occlusion becomes complete.

6. Therapeutic suggestions derived from a clinico-anatomic study such as the



one presented here are naturally limited. The material upon which it is based consists *a priori* of the cases least amenable to therapy, as discussed in detail elsewhere (Klien<sup>8</sup>). It would seem, however, that in younger patients with such systemic disorders as hypertensive disease, diabetes, and syphilis the clinical picture of venous occlusion is often produced by a more widespread but less complete venous circulatory embarrassment than in older patients with senescence only; therefore, anticoagulant and antispasmodic therapy would seem to promise more fa-

vorable results in the former. But, even in the latter, prompt therapy directed against secondary thrombus formation, postponing complete obstruction of the vein as long as possible, may save the eye by giving the necessary time for development of efficient collaterals. The most promising cases are the ones with early spastic disease. Such cases as nos. 7 and 8 in this series have come to the histopathologic laboratory most likely because of the occurrence of the vascular accident prior to the advent of anticoagulant therapy.

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# BILATERAL METASTATIC CARCINOMA OF THE CHOROID WITH X-RAY THERAPY TO ONE EYE\*

## REPORT OF A CASE

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*San Francisco 8*

Metastatic carcinoma of the choroid, while comparatively rare, has been reported a considerable number of times. Often it is bilateral, and in a definite percentage of cases the patient lives for one or more years after ocular metastasis occurs. By the time the eye is involved there is usually a generalized metastasis, so that any treatment to preserve vision is purely palliative. For obvious reasons the possible preservation of sight until death ensues is desirable. From the experience in the case reported here and in six other instances it would appear that radiation therapy offers some hope of accomplishing this end.

In 1872 Perls<sup>1</sup> reported the first metastatic tumor of the choroid in a man, aged 43 years, who had a primary carcinoma of the lung. In addition to the choroid of both eyes, many organs, including the brain, were involved. The subsequent cases have been collected and reviewed a number of times. Résumés of all the cases have been made by three authors. Usher<sup>2</sup> in 1923 collected 110 cases involving the choroid and iris; O. Ask<sup>3</sup> in 1934 collected 211 cases of uveal carcinoma in 59 of which the diagnosis was not histologically proved; in 1939 Giri<sup>4</sup> found that 170 cases of metastatic carcinoma of the choroid had been recorded. In addition to these mentioned, Lemoine and McLeod<sup>5</sup> reviewed all the cases of uveal metastasis and found 229

reports with 156 proved cases of metastatic carcinoma of the choroid on record.

Between the time of Giri's report and 1942 five additional proved cases have been reported by Schinz,<sup>6</sup> Kulvin,<sup>7</sup> Bonnet,<sup>8</sup> Von Sallmann,<sup>9</sup> and Pacheco.<sup>10</sup> In addition, two unproved cases were described by Aurand<sup>11</sup> and Luzsa.<sup>12</sup> More recently Bedell,<sup>13</sup> in presenting a photographic history of the development of bilateral carcinoma of the choroid in a woman aged 49 years, states that approximately 250 cases have been published or reported in discussion.

The incidence of metastasis to the choroid is low. As Ginsberg<sup>14</sup> pointed out Török and Wittelsdörfer found only one case in 366 cancers of the breast whereas Paquet found none in 733 cases. Schinz<sup>6</sup> within the last 20 years treated 536 cases of carcinoma of the breast at the Roentgen Institute of Zürich. Among these only three cases showed metastases into the choroid. Giri<sup>4</sup> believes that the rarity of choroidal metastases may be due to the fact that the ophthalmic artery branches from the internal carotid almost at right angles, so that cancer cells in the blood stream are easily swept past the comparatively narrow opening of the ophthalmic artery and deposited in the brain and meninges. It is Mann's<sup>15</sup> opinion that these metastases are probably much more common than is usually thought, as they are apt to occur in the terminal stages of carcinomatosis. Few ophthalmologists see more than one case; Fehr<sup>16</sup> saw four cases as did Greenwood;<sup>17</sup> Usher<sup>18</sup> observed five cases.

In by far the majority of cases the

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tumor is situated in the posterior pole of the eye. As Duke-Elder<sup>10</sup> states, one would expect the vast majority of emboli to travel up the 20-odd short posterior ciliary arteries rather than the 2 long posterior or the 5 anterior arteries. The posterior region of the choroid is therefore the site of election and the tumor is most frequently found on the temporal side near the macula where the short posterior arteries are most numerous and largest. According to Ginsberg<sup>14</sup> the left eye is more frequently involved than the right. Parsons<sup>20</sup> says this corresponds with the greater frequency of left cerebral embolism and is due to the same cause; namely, the more direct pathway by the left carotid which comes off from the aorta, whereas the right comes off from the innominate.

Involvement of the anterior segment is rare. Usher<sup>2</sup> in 1922 found only 8 cases, and Sanders<sup>21</sup> in 1938 found only 27, of which 17 were microscopically proved to be metastatic carcinomata. The choroidal metastases are more common than those of the iris and ciliary body by a ratio of 156 to 17. Sanders also feels that this can be explained by the numerical difference in the arterial distribution to the anterior and posterior uvea. Ask<sup>3</sup> pointed out that there are probably numerous cases of metastases to the ciliary body that are overlooked because they are small and cause no symptoms.

Involvement of the ciliary body alone is very rare, and only two cases have been reported. In 1929 Arnold Knapp<sup>22</sup> reported a metastasis in the ciliary body of a woman aged 68 years, who had had a breast removed for carcinoma eight years previously. The eye was enucleated and the woman lived 16 months longer. The second case was a patient of Ohr and Johnstone<sup>23</sup> who had an isolated metastasis to the ciliary body secondary to a carcinoma of the thyroid.

There have been only four cases in which the growth has been shown histologically to be limited to iris tissue. The first was reported by Proctor and Verhoeff<sup>24</sup> in a woman aged 72 years, with a carcinoma of the breast; the second was in a patient of Bolack, Bertillon, and Rogues<sup>25</sup> who had had a carcinoma of the breast removed three years previously; the third was in a man aged 68 years, with a carcinoma of the esophagus seen by Larson,<sup>26</sup> while in Sanders's<sup>21</sup> patient the site of the primary tumor was not located. In three of the cases the diagnosis was made following an iridectomy which included the carcinomatous nodule. In Larson's case this was done *post mortem*.

Smoleroff and Agatston<sup>27</sup> reported a case of metastasis to the retina without involvement of the choroid in a man of 55 years, suffering from an adenocarcinoma of the lower end of the esophagus and cardiac end of the stomach. This is the only recorded case of metastatic involvement of the retina by carcinoma.

The metastases are not infrequently bilateral, both eyes being affected, not, usually simultaneously but one following the other. Simultaneous involvement of the brain is common. Cohen<sup>28</sup> says that both eyes show metastases in one fourth of the cases but rarely simultaneously. Usher<sup>2</sup> gives the percentage of bilateral cases as one third whereas Lemoine and McLeod's<sup>5</sup> figures show 20.8 percent. Ginsberg<sup>14</sup> states that in 25 percent of the cases both eyes are involved and that the second eye may be involved by extension along the nerve. This, however, is not the rule, and the probabilities are that the metastasis in the second eye is due to a new hematogenous sowing not from the primary growth, but from the brain.

The site of the primary tumor in the majority of the cases is in the female breast. Cohen<sup>28</sup> gives 70 percent of the cases as due to mammary carcinoma,

while Usher,<sup>2</sup> who collected 90 cases, found 65 primary in the breast. Giri<sup>4</sup> in 1939 found that 65 percent of the cases were primary in the female breast. Giri also reported the case of a 69-year-old male who had a carcinoma of the breast with metastases to the choroid the metastatic tumor being typical of carcinoma of the breast. This is the only case of metastasis to the eye from a male-breast malignancy. Ewing<sup>29</sup> says that the frequency of carcinoma of the male breast varies between 0.86 percent of all mammary carcinoma in one series and 6 percent in another. In all, 244 carcinomas of the male breast have been reported. They occur in a later-age group than in women, are less malignant, persistent in growth, and may have local and general metastasis. Next in frequency to the breast, the lungs and bronchi, according to Giri,<sup>4</sup> account for 10 to 13 percent. Ask<sup>3</sup> found 15 percent of proved cases to be primary in the lungs and bronchi. Among the cases reported as secondary to malignancy in these structures were those of Ask,<sup>3</sup> Köpp,<sup>30</sup> and Koyanagi.<sup>31</sup> The alimentary tract accounts for about 7 percent of the cases. Among the more recent examples is one of the lower bowel reported by Kiep,<sup>32</sup> and one in the esophagus by Larson.<sup>26</sup> Only three histologically confirmed cases of metastasis to the choroid from a tumor of the rectum have been reported, those of Arisawa,<sup>33</sup> Dixon and Benedict,<sup>34</sup> and Von Sallmann.<sup>9</sup> The primary tumor has been reported in the prostate by Kulvin,<sup>7</sup> Greenwood and Southard,<sup>35</sup> Fehr,<sup>16</sup> Stallard,<sup>36</sup> and F. Ask.<sup>37</sup> Venco<sup>38</sup> reported a case originating in the thyroid. He was able to find five other cases recorded in the literature. They all showed a very slow course of metastasis. Choroidal metastases have also been reported from tumors in the liver and adrenals.<sup>14</sup> Holden and Rusk<sup>39</sup> report metastasis from a primary carci-

noma of the ovary and Dimissianos<sup>40</sup> one from a carcinoma of the parotid.

It is rather generally accepted that metastasis takes place through the blood stream. Cohen<sup>28</sup> says the cancer cells are transported by the blood stream from the original sources to the ocular structures. Here the cells form emboli in the ocular vessels and finally break through the vessel walls into the surrounding tissues. This viewpoint is based on the finding of capillary- or precapillary-carcinoma emboli by a number of workers (Perls,<sup>1</sup> Ginsberg,<sup>41</sup> and Fry<sup>42</sup>). The lung finding would bear this out. Greenwood<sup>17</sup> reported four cases in which the lungs clinically or pathologically showed evidence of lung metastasis. O. Ask<sup>3</sup> points out that a positive lung finding makes a hematogenous metastasis probable; it has, however, been shown that cancer cells often appear in the lung capillaries without causing metastasis.

It can be statistically demonstrated that certain types of cancer of the breast, lung, and probably also prostate comparatively often produce uveal metastases, whereas other types such as cancer of the stomach, uterus, and ovary rarely affect the uvea. Thus while carcinoma of the breast causes over 50 percent of the uveal metastases, its general incidence is only 13.5 percent, while carcinoma of the stomach with a relative frequency of 36.5 percent gives rise to only 3.3 percent of uveal metastasis. O. Ask<sup>3</sup> says this can be explained on a basis that certain types of tumor have a tendency to hematogenous metastasis. He feels that the presumption of a specific affinity of the uveal tissue to certain ocular metastases does not seem indicated. Lemoine and McLeod<sup>5</sup> favor the theory of a specific affinity of uveal tissue, particularly the choroid, for cells coming from carcinoma of the breast.

Since 65 percent of the primary tumors

are in the breast, Giri<sup>4</sup> points out that 70 percent of the cases are in women, whereas in men, according to Usher,<sup>2</sup> the primary tumor is most frequently in the lungs. The greatest number occur in the age group between 40 and 49 years, the next group between 50 and 59 and the third between 30 and 39. Below the age of 30 and above 70 the occurrence is very rare.

The length of time between the appearance of the carcinoma and uveal metastasis varies a great deal. In carcinoma of the breast it may be a matter of weeks or years. In two cases reported by Rieth<sup>43</sup> the eye became involved 3 and 6 years, respectively, after amputation and in Kiep's<sup>32</sup> patient the choroidal lesion made its appearance 2½ years later. As already stated, Venco's<sup>38</sup> patient did not develop metastasis from a carcinoma of the thyroid until 14 years later. There was a similar length of time in the other five cases of metastasis from the thyroid reported in the literature. In Von Sallmann's<sup>9</sup> patient, who had a carcinoma of the rectum, there was a 10-year interval between the discovery of the primary tumor and the ocular metastasis. At times the metastatic growth in the choroid may be the first indication of malignancy. Reese<sup>44</sup> reported five cases wherein the metastatic lesion of the eye manifested itself before the primary site was located. Bietti<sup>45</sup> saw two patients with bilateral metastatic choroidal tumors in whom there was no evidence of a primary growth. Similar cases have been reported by Sanders,<sup>21</sup> Arisawa,<sup>38</sup> Dimissianos,<sup>40</sup> and many others.

#### CLINICAL COURSE

The best descriptions of the clinical course are by Giri<sup>4</sup> and Fehr.<sup>16</sup> In the beginning one or more rather well-outlined round, pale-gray, pale-yellow, or yellowish-gray flat foci, over which the

retinal vessels pass with a slight bend, appear at the posterior pole of the eye. The patch or patches increase in extent fairly rapidly and become slightly more prominent and, where they are close together, fuse into a large, flat, somewhat nodular tumor. At times there may be considerable mottling. Over the greater part of the tumor the retina is cloudy and opaque in appearance. This cloudiness disappears at the edges of the tumor which are not sharply defined.

The disc may become reddened, with blurred edges. While at first the retina lies on the surface of the tumor, sooner or later a folded detachment develops that becomes complete. The detachment seldom shrinks into a strand, as noted in choroidal sarcoma. As pointed out by Clapp,<sup>46</sup> on rare occasions in the further course of the carcinoma of the choroid the retina may become reattached to the tumor mass. The whole of the growth may spread rapidly in all directions and ultimately surround the disc. It always remains flat and is very rarely elevated more than 2 mm. There is no new vessel formation although small hemorrhages on the surface are not uncommon. In Köppl's<sup>30</sup> patient the picture was very suggestive of acute choroiditis. According to Usher<sup>2</sup> the tension of the eyeball may be normal, increased, or in a few cases be reduced. If the tension is increased it is usually amenable to miotics.

Certain characteristics help to differentiate choroidal carcinoma from sarcoma of the choroid. The increase of the growth occurs more rapidly than in a flat melanoma. Glaucoma is late in appearing, but pain is earlier and more pronounced than in primary tumors. In sarcoma, owing to the fact that the retina does not detach as early and does not become cloudy, the details of the tumor-surface formation are visible according to Fehr.<sup>16</sup> In carcinoma, on the other hand, the retina be-

comes cloudy and opaque early, so that the tumor is not visible or perhaps visible only at the edge. In carcinoma the lamina vitrea is rarely perforated but it can perforate, as does sarcoma, and grow into the subretinal space or perforate the retina. As the result of necrosis the tumor may cause inflammation; it may also extend along the nerve and may perforate the sclera. Bilateral involvement always suggests metastatic carcinoma, particularly in the presence of carcinomatous history.

#### HISTOLOGIC PICTURE

The typical pathologic changes in the ocular structures consist primarily in the presence of carcinomatous elements and have been described in detail by Ginsberg.<sup>14</sup> As already stated the metastases are found primarily in the area supplied by the short ciliary vessels of the posterior half of the globe. The cancer cells reach the small arterioles where they have been found by Abelsdorff,<sup>47</sup> Cohen,<sup>28</sup> and others. The cells seem to proliferate primarily in the small veins, however. The vessel is blocked, the cells proliferate and burst through the vessel wall to proliferate in the perivascular spaces and stroma. From here they can again break into other vessels. In the case described by Smoleroff and Agatston<sup>27</sup> the infiltrate around the vessels in the scleral canal was continuous with the mass within the eye. As previously stated, the tumor is almost always flat and not more than 2 mm. in thickness. Krukenberg<sup>48</sup> reported an unusual case in which the tumor filled two thirds of the eye. The lamina vitrea is rarely perforated, although Ginsberg<sup>14</sup> saw an instance in which the tumor had broken through into the subretinal space similar to the occurrence in sarcoma. Steichele<sup>49</sup> and others have shown that it is occasionally broken through from the disc.

With the development of the tumor the course may be exactly that of a primary choroidal growth in that it may cause detachment of the retina, glaucoma, and inflammation; can invade the optic nerve and sclera, and perforate externally. It is noteworthy that the choroidal carcinoma relatively frequently produces dissemination within the globe. Abelsdorff<sup>47</sup> and Ewing<sup>50</sup> among others have found small isolated nodules not connected with the main tumor, not only in the choroid but also in the ciliary body and iris. Orth<sup>51</sup> found the lamina cribrosa and anterior part of the nerve involved in this case. Evans's<sup>52</sup> patient developed metastasis to the optic nerve and chiasma late in the disease after the choroidal tumor had disappeared following radiation. While the sclera may be involved, extraocular extension is uncommon, probably because death usually occurs before this happens. It has, however, been reported by Usher,<sup>2</sup> Cohen,<sup>28</sup> and others.

According to Duke-Elder,<sup>19</sup> the histology of the tumor depends upon the nature of the primary growth, but varies considerably. In those tumors secondary to carcinoma of the breast the neoplasm consists, in most instances, of alveoli of various sizes containing large round polygonal cells with single large nuclei. Sometimes the stroma between the cells is scanty, in other instances it is profuse. The choroidal tissue is compressed and degenerates, and the chromatophores are disintegrated, which results in a dumping of escaped pigment. When the tumor is derived from tissue containing mucous membrane or glandular tissue (stomach, bowel, liver, and thyroid) or from the lungs it is adenocarcinomatous in type.

As has been stated, the type of tumor varies according to its primary source, and almost always it assumes the type of the primary cancer. Rather interesting is the case of Bock.<sup>53</sup> A primary tumor of

the liver had metastasized to the skin, muscles, arachnoid, lungs, orbit, and choroid. In the choroid there was a deep-green-colored, bean-sized tumor containing cylindrical cells arranged in tubules which contained green gall that chemically was shown to be biliverdin.

The rapid growth of the cells around the vessels may, at times, cause erosion and produce hemorrhage into the growth and surrounding area. The circulatory disturbance may also cause necrosis due to ischemia. As Uhthoff<sup>54</sup> pointed out, this necrosis may occur even in a relatively young tumor. Stock<sup>55</sup> reported a case of bilateral choroidal metastasis from a suprarenal capsule tumor in which the vessels were filled with tumor cells and the area surrounding these vessels showed considerable inflammatory reaction.

In addition to the typical metastatic carcinoma of the choroid from a primary lung tumor Koyanagi<sup>21</sup> found another probably benign growth had arisen from the pigment epithelium overlying the choroidal tumor.

### PROGNOSIS

The prognosis in these cases is invariably bad; they always end fatally.

In carcinoma of the breast the interval between the appearance of the tumor and metastasis may be weeks or years, according to Cohen.<sup>28</sup> In Rieth's<sup>43</sup> cases metastasis occurred three and six years after breast amputation. Kiep<sup>32</sup> had a patient with a carcinoma of the bowel in whom ocular metastasis did not appear for two years. In certain tumors there is an apparent tendency to metastasize late. In Von Sallmann's<sup>9</sup> case, a metastatic carcinoma of the rectum, there was a 10-year interval between the diagnosis of the primary tumor and ocular involvement. As Venco<sup>38</sup> has pointed out, the rare cases of metastasis from a carcinoma of the thyroid have all occurred years after dis-

covery of the tumor, in his case 14 years.

Once metastasis has occurred the prognosis is extremely bad. Cohen<sup>28</sup> says that patients with unilateral cases may live a few years but that those with bilateral cases rarely live more than a few months. A great many of these patients are already cachectic, and multiple metastases are present, so that death may occur soon after the diagnosis of ocular metastases have been made, as was true of Köppl's<sup>30</sup> patient who died five weeks after the eye symptoms appeared. Usher<sup>2</sup> in 1923 stated that the average duration of life after the eye was affected was nearly eight months, the longest time recorded up to that time being two years. In 1938 Evans<sup>52</sup> reported a patient with bilateral metastasis who lived 2 years and 4 months after the diagnosis of ocular involvement had been made.

### TREATMENT

It has been stated that treatment is palliative and unnecessary unless the eye is giving rise to pain. We have seen that some patients even with bilateral choroidal metastasis may live for a considerable time. Therefore any therapy that may preserve useful vision for the duration of life is justified, even though it is purely a palliative measure.

Therapy has been limited to irradiation, and there are only a few scattered reports of this form of treatment.

Wilmer<sup>56</sup> reports the case of a woman, aged 40 years, seen in October 1928, who five months prior to examination had had the left breast and axillary glands removed for adenocarcinoma. Three months later there were bilateral metastases; more marked in the left eye. The vision of the right eye was 20/20 and of the left, 20/200. The patient was given radium therapy of both eyes. A single portal of entry was employed on each side. A heavy lead cylinder with a 2-inch aperture was



placed against the skin of the temple and the radium placed in a cylinder 3 inches away from the skin. The beam was so directed as to "spare the cornea and perhaps the lens." Between October 15 and November 6, 1928, each eye received 16.8 gram hours of irradiation, and between January 10 and 16, 1929, an additional 12 gram hours were given.

Six months after irradiation was started the tumor mass in the right eye was chalky, yellowish-red in color, and was elevated only 3 diopters instead of 8 to 10. There were deposits of disintegrated and accumulated pigment granules in the retina over the tumor. In September, 1929, the right eye received 5.6 gram hours of radiation and the left 7.7 gram hours.

The patient died two years after irradiation had been started, and during this time the right eye retained normal function and the vision of the left eye remained at 20/200.

Zentmayer<sup>57</sup> in 1932 reported the case of a woman aged 60 years, who had bilateral metastatic carcinoma of the choroid secondary to a carcinoma of the right breast. The vision with correction was 6/60 in the right eye and 6/30 in the left. The tumors were the typical flat, yellow-white masses with some mottling of the surface. Radium treatment was administered in the form of two radium packs; felt 2 by 4 cm. and 1 cm. thick. Radium needles were distributed to give homogeneous irradiation over an area 2 by 4 cm. A total of 50 mg. was applied to each plaque and fixed to the right and left temporal regions just behind the external canthi. Filter of 1 mm. brass and 1 mm. lead was used; distance 12 mm. Further treatment was refused because patient's physician told her it was almost sure to produce glaucoma. There was a further gradual involvement of the choroid with vision finally being reduced to perception

of hand movements. The tension never became elevated, being 18 mm. of mercury in each eye. Zentmayer also wrote that in a letter from Dr. deSchweinitz, he refers to a case of his own which was treated with radium at the Johns Hopkins Hospital, with beneficial results.

Evans<sup>58</sup> in 1937 described the successful use of radon in a bilateral choroidal metastasis secondary to a breast carcinoma. The patient, a woman, aged 41 years, had one eye enucleated three years after the breast amputation. Examination revealed a metastatic adenocarcinoma of the choroid. Six weeks later the right eye showed a metastatic tumor, with the vision reduced to 6/36. The eye was prepared as for diathermy operation and 4 radon seeds of 1.72 millicuries each were stitched to the sclera over the area of the growth. At the end of a week the radon seeds were removed by a second thread which had been attached to the seeds to permit removal. Two months later the vision was normal; the retina was entirely flat, the yellowish growth having disappeared. There was, however, a widespread choroidal reaction in all directions which involved the macular area. The field of vision was normal for 0.5-degree test object at 33 cm. Seven months later there was a recurrence of the growth above the disc. Radon seeds were again used in a similar manner. Two and a half months later the vision was 6/12 and the retina flat. Fifteen months later Evans<sup>52</sup> reported that the treatment had been effective for a period of 2 years and 4 months. During the last six months the vision failed owing to metastatic growths in the optic nerve and chiasma, as proved at autopsy. In his conclusion Evans stated that "radon may prove to be of value as a curative form of treatment in an otherwise hopeless condition and should be considered as an alternative to enucleation of the eye."

The use of X-ray therapy has been reported three times.

Uchermann<sup>59</sup> in 1928 reported the case of a woman, aged 35 years, who had an inoperable carcinoma of the breast. Clinically there was a bilateral metastatic carcinoma of the choroid. The patient was given three X-ray treatments of each eye over a period of four weeks. The vision of the right eye improved from 5/50 to 5/10 and the left from perception of fingers at 10 feet to 5/50, and the patient was again able to read. The fundi showed no demonstrable improvement. There was no further follow-up and no histopathologic report.

Lemoine and McLeod<sup>6</sup> reported on a 72-year-old woman with bilateral metastasis of a breast carcinoma in whom the left eye, which was enucleated because of pain, showed a metastatic carcinoma of the choroid. The right eye, which also contained a metastatic tumor, was given 1,645 r over a period of five weeks. Two months later there appeared to be about 1 diopter of elevation at the site of the tumor, with marked pigmentary changes about the macula and along the lower temporal artery. The vision was 15/50, and the patient was able to read and write. The lens opacity which was present before irradiation "had not changed much as the result of the radiation therapy." Microscopic examination of the right (irradiated) eye showed a flat tumor mass in the choroid with cell clumps showing the same appearance as those seen in the left eye. The majority of the tumor-cell nuclei were necrotic.

The third case was reported by Reese in the discussion of Lemoine and McLeod's paper. Additional data were obtained from Reese in a personal communication. The patient, a 53-year-old woman, reported to Dr. John Wheeler on March 29, 1936, complaining of eye symptoms of four months' duration.

Right eye vision was the perception of fingers at one foot, left eye 20/200+ unimproved by lenses. Fundus examination: Right eye, media clear. Temporal to disc and extending well out into the periphery was a markedly elevated yellowish-gray area. There were numerous small hemorrhages upon this, and a densely pigmented area below and temporal to the macula. Along the upper edge there was a similar, less dense pigmentation. The lower portion of this area was connected by an isthmus to a grayish elevated area in the inferior portion of the fundus. Left eye: media clear. About and temporal to the disc, extending above and including the macula in its edge, was a raised yellowish-gray area. There were small yellowish and brownish areas upon this elevation. There was a large hemorrhage below and temporal to the disc. A diagnosis was made of metastatic carcinoma of both choroids, later found to be primary in the thyroid.

The right eye was enucleated, and microscopic study confirmed the diagnosis. X-ray therapy was directed to the left eye. Between March 3 and 8, 1936, the patient received 1,808 r of border-ray treatment. Between March 14 and June 24, 1936, 12 doses of X-ray irradiation, 300 r, were given to the left temple lateral to the canthus and 12 similar doses to the right side of the bridge of the nose. On June 11, 1936, the vision of the left eye with correction was 20/30. Two months later the lesion of the left eye seemed more extensive and the vision was 20/20-2. Two months later the patient died. Reese concluded that treatment by irradiation improved the vision apparently due to temporary regression of the tumor.

#### CASE REPORT

Mrs. D. B., aged 31 years, was referred by Dr. C. K. Mills of the Woodland Clinic for consultation on August 20,

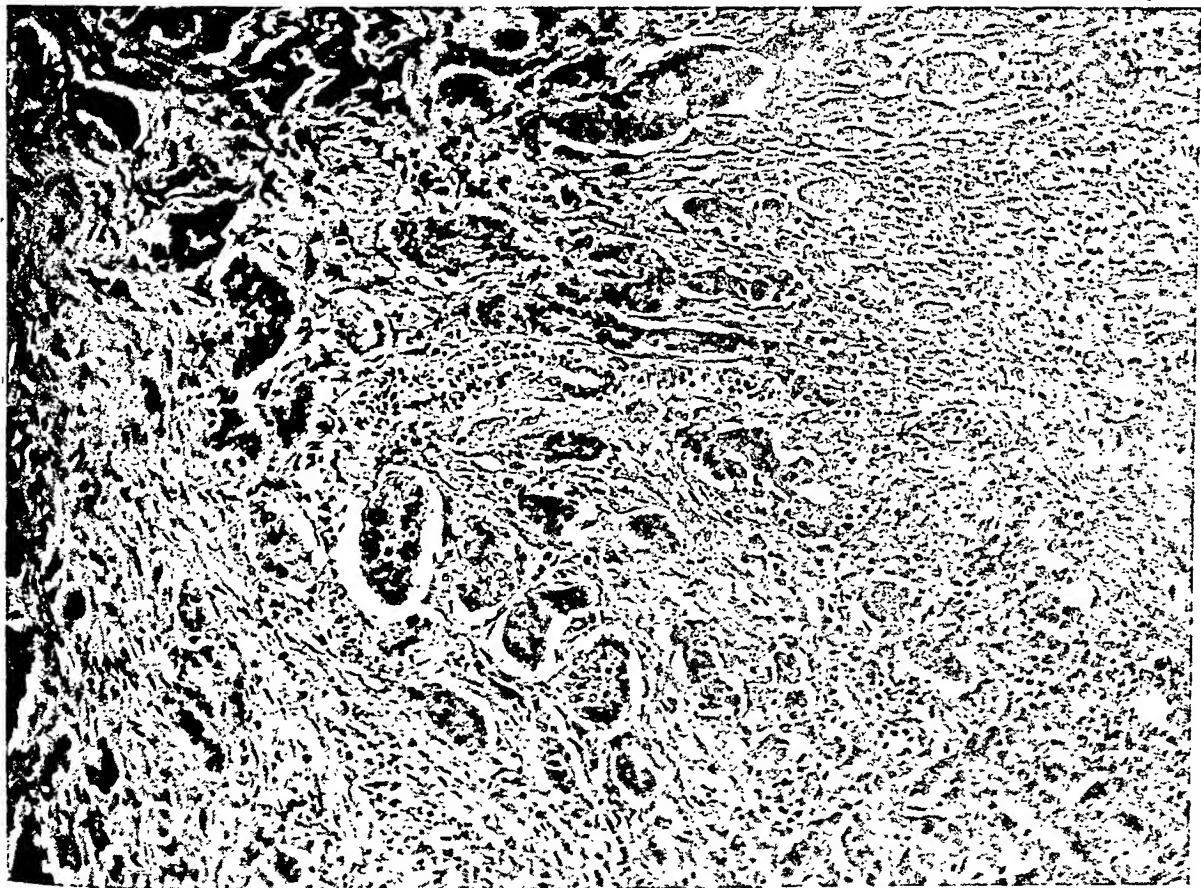


Fig. 1 (Cordes). Primary growth in breast. The cells are large and pleomorphic with occasional tendencies to form glands. A somewhat marked stromal reaction would suggest classification as a scirrhous adenocarcinoma.

1941, with a diagnosis of suspected metastatic carcinoma of the choroid. The patient had been seen for the first time two days previously and gave the history of poor vision in the left eye for approximately six weeks. Five months previously (March, 1941) the patient had had a radical amputation of the left breast for a carcinoma which had metastasized to the axillary lymph nodes. The radical amputation of the breast was performed by Dr. E. T. Rulison of Sacramento, who kindly forwarded the report from the pathology laboratory. From sections of the breast and axillary nodes a diagnosis of metastatic scirrhous carcinoma of the breast was made (fig. 1).

*Examination.* Vision, R.E., 1.0; L.E., 0.8. External examination was negative.

Fundi, R.E., negative; L.E., media clear. A large detachment of the retina was present involving the nasal half of the retina and extending into the lower temporal quadrant. There was a large rather sharply outlined round area just nasal to the disc that was grayish-white in color, rather mottled in appearance, and solid looking. The retina appeared to be cloudy over this area but opaqueness was absent in other parts of the detachment. While the detachment was extensive it was rather flat (fig. 2).

Intraocular pressure, R.E., 19; L.E., 16.5 mm. Hg (Schiotz).

Transillumination was of no value.

Perimetric fields showed loss of field in the temporal half of the field extending into the upper nasal quadrant. This cor-

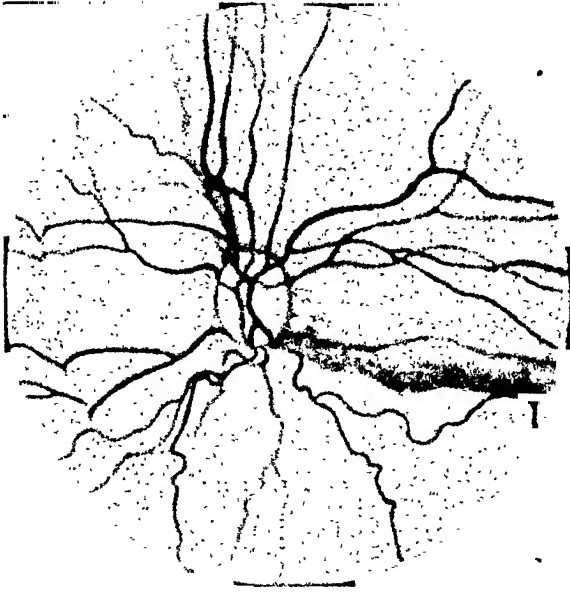


Fig. 2 (Cordes). Left eye. Showing large, rather flat detachment.

responded to the area of detachment. Perimetric field studies of the left eye were negative.

The diagnosis of metastatic carcinoma of the choroid was confirmed and, in view of the fact that there was no other involvement apparent on physical examination, enucleation was advised. Two days later the eye was enucleated by Dr. Mills,

and the specimen was sent to Dr. D. Wood of Stanford University from whom sections were obtained.

**PATHOLOGICAL REPORT (Dr. M. J. Hogan):** The structures in the anterior globe are very distorted by the method of sectioning, but seem normal.

**Choroid.** There is a fairly extensive flat tumor of the choroid posteriorly in the region of the optic nerve (fig. 3). The cells are formed into strands by the choroidal stroma and are large and polygonal. A tendency to gland formation is seen here and there. There are three emissaria in the sclera beneath the tumor which are surrounded by tumor cells. At one point there are three small seedings into the retina over the tumor, but the subretinal space is only slightly involved. Only a few mitoses are seen. There is no keratinization (fig. 4).

**Optic nerve cross sections:** these show no extension of the tumor.

**Diagnosis:** Metastatic carcinoma of the choroid with extension into sclera and retina.

On September 17, 1941, four weeks after the initial examination, the patient returned complaining of flashes of light before the right eye.

**Examination.** Vision, R.E., 1.0. Fundus: Disc not remarkable. Just temporal to the macula was a flat detachment of the retina which was elevated 4 to 5 diop-



Fig. 3 (Cordes). Flat tumor of choroid posteriorly in the region of the optic nerve ( $\times 8$ ).

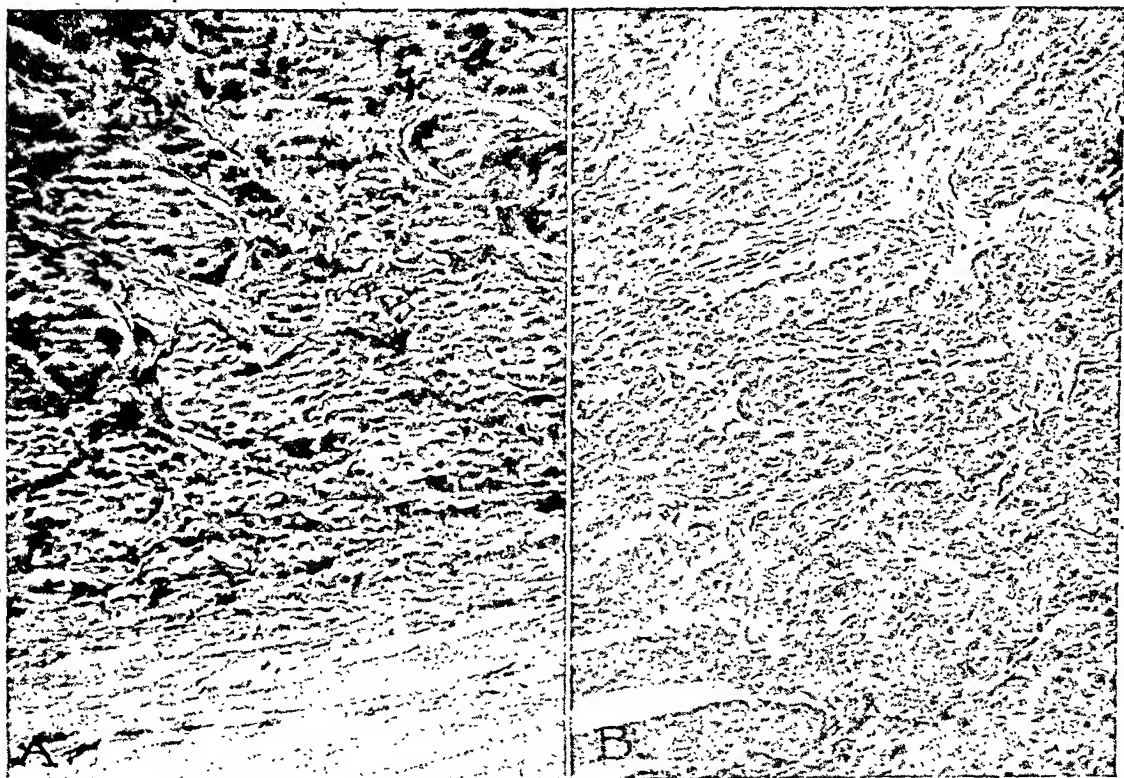
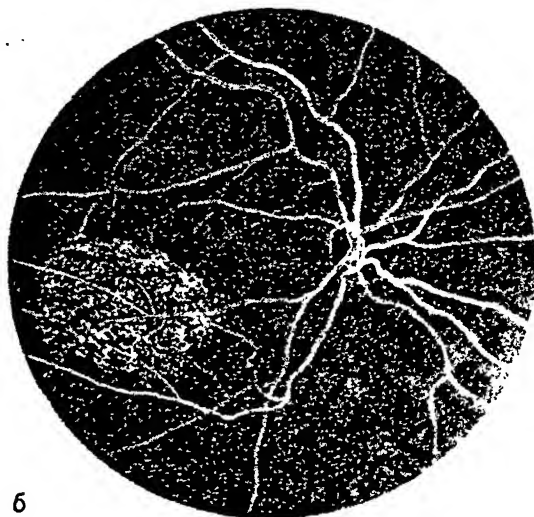
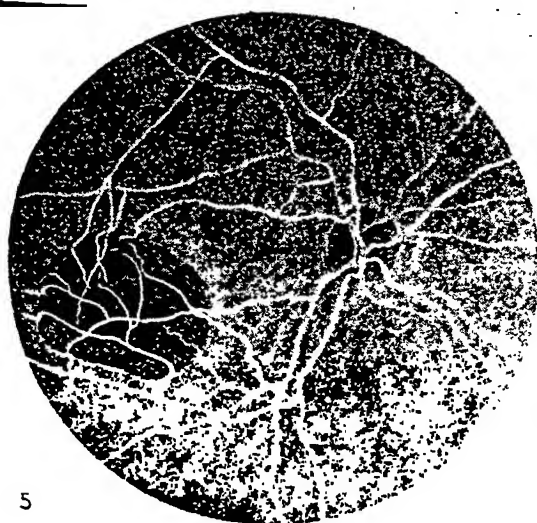


Fig. 4 (Cordes). Metastatic tumor ( $\times 120$ ). The metastasis is composed of the same pleomorphic type cell arranged in strands and cords which have separated the choroidal lamellae in the region of the posterior pole of the eye. There is an occasional tendency to show gland formations. Stromal reaction is much less. The type is adenocarcinoma. A and B show sections from separate portions of the tumor.

ters. It was somewhat mottled in appearance and yellowish-gray in color. The area was sharply outlined and the detachment had a solid appearance.

Perimetric field examination revealed a scotoma in the nasal field corresponding in size and shape to the detachment of the retina (fig. 5).



Figs. 5 and 6 (Cordes). Figure 5, right eye showing the metastatic carcinoma of the choroid. Figure 6, fundus, right eye, after irradiation, showing pigment changes.



Tension 22 mm. Hg (Schlötz).

A diagnosis of metastatic carcinoma of the choroid was made and X-ray therapy advised.

*X-ray treatment.\** On September 18, 1941, X-ray irradiation was started. The patient was treated from two lateral fields; the one on the right was rectangular 6 by 8 cm., and the one on the left was 10 cm. square. She received a total of 1,675 r to the right field and 1,640 r to the left. This was given over a period of one month. During the same time the patient was also given a roentgen castration with 1,000 r to two fields over her pelvis. The treatment factors were 195 K.V.P., 16 milliamperes, filter  $1\frac{1}{2}$  mm. copper and 1 mm. aluminum. The focal spot distance was 50 cm.

Dr. Mills wrote that 12 days after X-ray treatment was started the lesion was slightly but definitely less elevated and simultaneously with this decrease the patient stated that her annoying flashes of light had disappeared. One month after irradiation the elevation of the mass was about 1 diopter.

January 24, 1942, four months after irradiation, the patient was examined in the office.

Vision: R.E., 1.0. Perimetric fields and central fields showed no scotoma. In the fundus there was an area of retina corresponding to the site of the previously present tumor that seemed somewhat pale. The color seemed a little irregular, as though there had been some disturbance in the choriocapillaris layer and in the retinal-pigment layer. This was most pronounced above and temporal to the macula. The retina was flat.

The patient was seen at monthly intervals, and no change was observed until June 2, 1942, when she returned stating

that she was having trouble with her legs due to involvement of the sacroiliac portion of the spine. She was receiving X-ray therapy for this lesion.

August 19, 1942. The patient complained of a return of flashes of light before her right eye. The vision remained at 1.0, and no visible change was seen in the fundus. Central fields on the screen did, however, reveal an indefinite defect in the nasal quadrant corresponding to the site of the lesion before X-ray therapy had been instituted. The lesion in the spine was better, and the patient had no trouble with her legs.

November 2, 1942. The indefinite field defect noted at the last examination had developed into a positive scotoma to the temporal side of the macula. Fundus examination showed a sharply circumscribed solid-looking detachment of the retina elevated almost 2 diopters in the area corresponding to the scotoma.

X-ray therapy was advised, and the patient received treatment from two lateral ports. "On the right side she was treated through a port 2 by 3 cm., centering on the posterior part of the orbit. The eyebrows and eyelashes were protected as far as possible with lead shielding. Through this port she was given 3,346 r measured in air at the skin. The other factors were 190 K.V.P., 16 milliamperes with filtration of 0.65 copper. On the left side a slightly larger port and heavier filtration were used. The area measured 3 by 4 cm. The same protection to the eyebrows was given, but no protection could be given to the eyelashes because of the enucleation. Through this port she was given 2,500 r but with heavier filtration. The other factors were the same. The filtration was 1.65 copper. Treatment was given daily over a period of a month and a half, treating alternating fields with the exception that the patient skipped one or two days and was not treated on Sundays."

\*X-ray therapy was carried out at the Woodland Clinic by Drs. Earl Gray and Austin Clark from whom the data were obtained.

December 15, 1942. Vision R.E., 1.0. No scotoma present; retina flat—no further flashes of light.

February 12, 1943. Eyelashes previously lost were returning; otherwise condition remained unaltered. The patient had developed metastases in the lungs and shoulder girdle, for which she was receiving X-ray therapy.

April 26, 1943. Vision R.E., 1.0. The slitlamp failed to reveal any lens changes. Fundus: media clear, disc not remarkable. In the retina above and temporal to the fovea was an area that was lighter in color than the remainder of the fundus. Scattered through this area were fine dustlike clumpings of pigment. The retina was flat (fig. 6).

Perimetric fields showed a suggestion of a relative scotoma corresponding to the area of the retinal change.

Owing to progression of the lung lesions and development of new metastases in the hips, the patient was unable to return to San Francisco for further observation.

The patient died on July 16, 1943, 2 years and 4 months after the amputation of her breast and 23 months after the discovery of the tumor in her left eye. Dr. Clark of Woodland wrote that for two months prior to her death she had been having recurrent hydrothorax, bilateral, from pulmonary and pleural metastases. The vision remained normal throughout life.

The patient's mother refused autopsy and would not grant permission for removal of the eye.

#### COMMENTS

Metastatic carcinoma of the uveal tract is rare; approximately 250 cases have been published or reported in discussions. Of this group 25 percent were bilateral.

The site of the primary tumor in the majority of cases is in the female breast.

In addition the lungs, bronchi, alimentary tract, prostate, thyroid, liver, adrenals, ovary, parotid, and male breast have been noted as the location of the initial neoplasm.

The greatest number of cases occur in the age group of 40 to 45, the next group between 50 and 59 and the third between 30 and 39 years. Below this age and above 70 the condition is seen very rarely. The metastasis to the choroid may be the first indication of the malignancy.

The tumor has primarily the appearance of a flat, pale-pink, -gray, or -yellow area with a delimiting border that is faintly pigmented. Mottling is usually present. The tumor extends in surface rather than thickness, is thin, and is accompanied after a time by detachment of the retina; subsequent glaucoma may or may not accompany the lesion.

The prognosis in these cases, as has been pointed out, is invariably bad and they always end fatally. It has been said that patients with unilateral cases may live a few years, and that those with bilateral cases rarely live more than a few months. However, several cases have been reported where, with bilateral metastasis, the patient lived over two years. In one case the patient survived 23 months. While the prognosis is bad, any treatment that may preserve vision to the end of life should receive consideration.

Noteworthy also is that in the case here reported pulmonary metastases were present. Lemoine and McLeod found that 83 percent of autopsied cases showed pulmonary metastases.

From the few reports in the literature and personal experience it would appear that, in preserving useful vision, irradiation therapy is successful in a certain percentage of cases. The therapy has been given in two forms, radium emanations and X-ray irradiation.

The use of radium has been reported



by Wilmer, Zentmayer, and Evans. In Wilmer's case wherein one eye was seen early the preservation of 20/20 vision was possible and in the second more advanced eye the vision was 20/200. Evans was able to improve the vision from 20/200 to 20/20. This was retained for 2 years and 4 months. The application of the radon seeds must be done carefully. The eye is prepared as for a diathermy operation and the radon seeds are stitched to the sclera over the growth. It is then necessary later to remove the radon seeds, which can be done by means of a second thread which has been attached to the seeds to permit removal.

X-ray therapy has also been used successfully. The vision of Uchermann's patient improved from 20/200 to 20/40, that of Lemoine and McLeod's patient improved to 20/70, so that reading and writing were again possible. (In this patient a portion of the visual loss was due to lens opacities present before irradiation.) Reese was able to improve vision from 20/200 to 20/30 until a short time before death, when the vision dropped to 20/40—2. The patient herein reported retained 20/20 up to the time of death.

From the few available case records it is apparent that the earlier the patient is seen the greater the possibility of retaining useful vision.

The sensitivity of carcinoma to irradiation varies a great deal depending upon the type of tumor. This accounts for the variation of results obtained. In the case reported here the tumor, a primary scirrhous carcinoma of the breast, responded well to irradiation as was demonstrated by the rather easy control of the early isolated metastases to the spine, hip, and other parts. In both Wilmer's and Evans's patients the tumor was an adenocarcinoma of the breast.

As well as can be determined the results from radium and X ray are identical. The

proper application of radium requires a rather formidable operative procedure; in addition, radium is not always available in a smaller community. X-ray therapy can be given by any well-trained roentgenologist and is accessible practically everywhere. Thus it would appear that X-ray therapy is the treatment of choice.

Recurrence may take place, as seen in Evans's case and in the one reported here. In both instances further irradiation caused the lesion to regress.

Of further interest is the tolerance of the eye to irradiation. The patient was given 3,315 r at the time of the initial irradiation and at the time of the recurrence, 14 months later, an additional, 3,356 r were given, making a total of 6,671 r. Up to the time of death, eight months after the last irradiation, the lens failed to show signs of opacification. From this it would appear that if lens opacities develop it is not for some time.

Further experience with irradiation of these tumors may result in the indication for irradiation, even in monocular cases, before enucleation is considered, especially if the tumor is seen early.

#### SUMMARY

1. A case is reported of a woman, aged 31 years, who had bilateral metastasis to the choroid secondary to a scirrhous carcinoma of the breast.

2. One eye was enucleated and the diagnosis confirmed by microscopic examination.

3. With the appearance of a similar growth in the second eye X-ray irradiation was employed. This was followed by disappearance of the tumor and retention of 20/20 vision in the eye. Fourteen months later there was a recurrence. The eye was again irradiated, with regression of the tumor.

4. Employing X-ray therapy to the eye made it possible for the patient to retain

20/20 vision up to the time of death (23 months).

5. While the ultimate prognosis is hopeless, the possibility of retaining useful vi-

sion by means of palliative irradiation should receive consideration in cases of metastatic carcinoma of the choroid.

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# NOTES ON AN OPERATION FOR GLAUCOMA

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The operative procedure that is described in this communication was presented to the Indiana Academy of Ophthalmology and Otolaryngology as a preliminary report in April, 1937. At that time the operation had been performed upon 24 eyes (both eyes of six patients), beginning in January, 1934. The Academy members were informed that the operation was being presented to them in a spirit of humility engendered by the realization that it could probably be criticized for many reasons, and with the disturbing thought that it might have been previously outlined by some other eye surgeon. However, a rather careful study of the literature had not up to that time, and has not yet, uncovered the description of any operation just like it, although it incorporates some features of several other operations for the relief of glaucoma. The reason for calling it to the attention of the Indiana Academy was that it had given very satisfactory results with almost every eye upon which it had been performed. The fact that only a preliminary report was being made was definitely emphasized, since it was my feeling that a final report should not be made until at least 50 eyes had been subjected to the operation, and subsequently followed for at least two years, before reliable conclusions could be drawn regarding its efficacy. The description of the operation is as follows:

## 1. PREPARATION OF THE PATIENT

Is as for all other operations upon the globe, whenever it is possible to give sufficient time to the preparation. In the emergency of acute glaucoma, it is necessary to proceed with the surgery without the benefit of preliminary conjunctival cultures and so on.

## 2. ANESTHESIA

Five instillations of 4-percent cocaine solu-

tion are made at three-minute intervals, with 0.5 to 1 c.c. of 2-percent novocaine injected under the bulbar conjunctiva above the limbus. In acute glaucoma, injection of the ciliary-ganglion area with 1 to 1½ c.c. of 2-percent novocaine is required.

## 3. STEPS OF THE OPERATION

(a) After irrigation of the conjunctival sac and insertion of the speculum, a horizontal incision 12 mm. long and 1 cm. above the limbus is made in the bulbar conjunctiva with straight muscle scissors. The conjunctiva is dissected downward toward the limbus, the episcleral tissue also being picked up after the dissection has proceeded to a point below the insertion of the superior rectus muscle. Care is exercised to free the sclera carefully of all overlying tissue. The forceps, which are held in the operator's left hand, retain their grasp upon the conjunctival flap from the first snip of the scissors until the beginning of step (e). Fixation of the globe is thus maintained.

(b) With a Knapp knife needle, a horizontal scratch, 5 mm. long, is made in the sclera, 2 mm. above the cornea. This scratch is made with the knife-needle point, the stroke of the blade being made in the direction of its sharp edge, and with the knife held at an angle of about 45 degrees to the surface of the eye, instead of pointing straight in. After the initial stroke with the sharp edge of the point, thus definitely marking the line of the incision, the scleral section is completed deliberately and gently by strokes of the back, or dull side, of the knife-needle point. This step has for its objective the production of a purposely roughened, somewhat ragged incision in the sclera. As the last fibers of the sclera are divided, a quite characteristic sensation is transmitted to the surgeon's fingers, just as in the cyclo-dialysis operation. At this point great care and lightness of touch are indicated, to avoid injury to the underlying anterior portion of the ciliary body.

(c) A pair of fine-tipped, straight muscle scissors is next employed, to make a small snip at each end of the scleral wound. This snip is made with the scissor points directed toward the temporal limbus at the outer end of the incision, and toward the nasal limbus at the inner end. This procedure, which has been employed in the past at the inner and outer ends of a keratome incision for glaucoma iridectomy, has for its purpose the production of a flaplike valve. A filtering cicatrix, with bleb formation, is one of the objectives of this

operation. The purposely roughened scleral incision, with the snips at its ends probably aiding, *sometimes* accomplishes this objective.

(d) With the scleral section completed, a narrow iris spatula, somewhat curved, is introduced carefully into the incision. Hugging closely the inner surface of the sclera and cornea, the spatula is advanced into the anterior chamber. When its point comes into view in the anterior chamber, it is pushed gently forward to a position about half way between the pupillary margin and limbus. Danger of injury to the lens capsule is precluded by studiously avoiding the pupillary margin, thus keeping the iris between the spatula and lens. The spatula is next swept from side to side as far as the length of the incision will permit, thus separating the base of the iris from the cornea, and breaking up the meshwork of the iris angle. This step facilitates and makes safer the later introduction of the iris forceps for iridectomy. During the introduction and manipulation of the spatula, aqueous humor is drained from the anterior chamber, with the speed and amount of this drainage controlled by the care and precision with which the spatula is handled.

(e) The operator now transfers the conjunctival forceps to his assistant, who raises the conjunctival flap straight out from the globe, while a peripheral iridectomy is performed. The iris forceps are introduced with extreme care, their closed points hugging the inner surface of the sclera and cornea, just as the iris spatula was handled in step (d). This is the most difficult part of the operation, as the scleral opening is so small that it permits of only a moderate opening of the forceps. The latter are so flush on the surface of the iris, however, that only a very narrow opening of their tips is necessary to grasp the iris. Because of the location of the incision over the anterior portion of the ciliary body, it is probably reasonable to believe that a basal iridectomy is always obtained. Occasionally, in an eye that has rather markedly elevated tension, the iris will buckle into the wound as soon as the section is completed. In such instances the presenting iris is grasped, drawn out somewhat, and cut, with the deletion from the operation of steps (c) and (d).

The peripheral iridectomy may be replaced by the performance of a sphincter-dividing iridectomy or iridencleisis.

(f) The conjunctiva is closed with continuous or interrupted silk sutures, by picking up the subconjunctival tissue with the conjunctiva, and making sure that the former is drawn out smoothly over the underlying scleral incision.

The patient is kept in bed for two days and permitted to leave the hospital on the fourth or fifth postoperative day. No mydriatic is

used unless there is evidence of uveal irritation. Ten days following the surgery gentle finger massage is begun for a short period three times daily. The patient is permitted to begin light work about two weeks after the surgery.

Between January, 1934, and the time of the original report in 1937, this operation had been performed upon 24 eyes, as was previously stated. Since 1937, approximately 125 additional eyes have been operated upon according to this method. Every type of glaucoma, including chronic noncongestive, subacute and acute congestive glaucoma, and elevated intraocular pressure following a cataract operation, has tested the procedure. It has been the author's experience that response to this operation has been at least as consistently satisfactory as to any other type of surgery. Several eyes have required more than one operation to bring the pressure down to a consistently low level. Such has been the experience of many surgeons who have used other types of glaucoma operations. The reasons for the need of more than one operation are becoming much more intelligible to us since the development of gonioscopy. This will be further discussed in a later paragraph.

The purposes of this surgical procedure may be outlined as follows: 1. A slow drainage of the aqueous humor through the gradually developed opening of the sclera by the scratch type of incision. 2. Development of a filtering cicatrix as a result of the purposely roughened scratch incision plus the extension of the incision toward the limbus by scissor snips. 3. The aid to drainage provided by what might be termed anterior cyclodialysis. 4. A consistently obtained basal iridectomy.

The reasons for the failure of a single operation, performed by this method, to bring the tension down and keep it down have become more apparent since some of the eyes that were operated on have been examined gonioscopically. Our local group has been making gonioscopic ex-

aminations for such a short time that it has been possible to examine only a few of our postoperative patients by this method. The things that we have seen have been most enlightening, and they may be outlined as follows:

1. The extent of our iridectomy has not represented a sufficient degree of chamber-angle circumference to bring the pressure down satisfactorily in some patients, because too-extensive peripheral anterior synechia made an iridectomy alone ineffective. (In such patients, a modification of the procedure to substitute iridencleisis would have given much better results.)

2. No evidence of a cyclodialysis opening or pit has been found in any chamber angle thus far seen.

3. No patients have as yet been examined gonioscopically for evidence of a communication from the chamber angle to a filtering cicatrix. As our number of operations has increased, the percentage of eyes which developed a filtering bleb following surgery has been sufficiently low that there is no sound reason to report a consistently obtained filtering scar by this operative method, although a good bleb sometimes results.

With the hoped-for advantages of a cyclodialysis opening and filtering cicatrix not consistently obtained by the performance of this procedure, we are given to wonder what if any advantage it offers. We believe that there are two advantages; namely, the slow leakage of aqueous and

reduction of intraocular pressure obtained by means of the scratch incision, plus the basal iridectomy that is made possible by the location of the incision far enough back to come down upon the base of the iris with the iris forceps. Thus far, every postoperative eye that we have examined gonioscopically has exhibited a clean-cut basal iridectomy. There is no doubt that the scratch incision by invariably permitting slow drainage of the aqueous humor, is of the utmost value. Through this incision, a basal iridectomy can confidently be expected or an iridencleisis be performed with equal facility.

Gonioscopic examination will govern our preoperative plans in the future. Intelligent and rational choice of operation has been made possible by gonioscopy. The differentiation of wide-angle from narrow-angle glaucoma, together with determination of extent of angle block in the latter, will help us to decide whether cyclodialysis, iridencleisis, or basal iridectomy is indicated. Whatever type of operation we may elect, the advantage of the scratch incision remains constant.

In conclusion, it seems that the critical study of our results with this operation over a period of 10 years serves to prove the point that no operative procedure should be presented to our colleagues until a sufficient number of eyes has been subjected to the procedure and followed afterward for a sufficient time to give us an intelligent idea of the results.

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# AMBLYOPIA IN CASES OF READING FAILURE\*

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The frequent appearance of amblyopia among children referred for failure in learning to read prompted an investigation to find whether or not its incidence is really greater in such groups. The records of 100 children who failed to read were compared with those of an equal number

The group that had no reading trouble was found to be evenly divided between boys and girls.

The criterion of amblyopia was visual acuity of less than 20/20 in either or both eyes without demonstrable lesion, but unimproved by lenses. Each macula was ex-

TABLE 1

COMPARISON OF DATA FROM CASES OF READING FAILURE, WITH THOSE FROM SUCCESSFUL READERS

	Cases of reading failure	Successful readers
Number of cases	100	100
Age range in years	6 to 19	6 to 19
Average age in years	10	12

FREQUENCY  
(% of each group)

Amblyopia in either or both eyes	25	12
Amblyopia in both eyes	21	11
Amblyopia in left eye only	4	1
Amblyopia in right eye only	0	0
Both eyes equally amblyopic	17	6
Both eyes amblyopic, left the more so	3	2
Both eyes amblyopic, right the more so	0	3
Better vision with both eyes than with either separately	2	1

CENTRAL TENDENCY

	Right eyes	Left eyes	Both eyes	Right eyes	Left eyes	Both eyes
Average (arithmetic mean) visual acuity of amblyopic cases (Snellen)	20/40	20/60	20/30	20/40	20/50	20/30

known to be passing in reading but who had been referred for ocular complaints. The age range of the two groups was from 6 to 19 years, the average age of the poor readers being 10 years and that of the others 12 years. As is common in groups of reading-failure cases, previously studied by others as well as myself, 80 percent of the poor readers were boys.

amined with particular care, but no lesions were seen here nor elsewhere in the fundi of any eyes in either group. The poor readers exhibited twice as great a frequency of amblyopia of all categories, slightly less than twice as frequent bilateral amblyopia, and four times as frequent amblyopia of the left eye only. No cases of amblyopia in the right eye only were found in either group. A little less than three times as many poor readers were *equally* amblyopic in each eye. The

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incidence of bilateral amblyopia with a greater degree of defect in the left eye was only slightly different in the two groups, whereas the poor readers presented no case in which the amblyopia was greater in the right eye than in the left. Twice as many poor readers experienced better vision binocularly than with either eye separately. A quarter of the same group were amblyopic in one or another category and about a fifth of them were amblyopic in both eyes.

The average amount of amblyopia was studied in terms of visual acuity below 20/20. The only difference between the groups in this respect was that the poor readers showed an average of one Snellen line poorer vision (that is, greater amblyopia) in the left eye. The average visual acuity for the right eyes only and both eyes together was the same in each group.

Amblyopia may be either a neurologic defect, concomitant with partial word blindness, or a primary factor impairing reading ability through visual inefficiency. It is probably one of many physical factors that participate to a greater or less degree in different cases of reading failure. The fact that the incidence and average amount of amblyopia of the left eye

only was greater among poor readers discloses an unexpected tendency which will bear investigation in later studies.

The treatment of children who fail to read and are amblyopic involves the usual remedial teaching techniques supplemented by sightsaving-class methods, when vision is very poor, and by amblyopic exercises. Not much is to be expected of such exercises, but they should be tried. Sometimes surprising visual gains follow, especially among children in the lower grades. This may be due to late maturation. If so, amblyopic exercises may foster the process of visual development.

#### SUMMARY

The records of 100 cases of reading failure were compared with those of an equal number of children who were known to be passing in their school studies. A considerably greater incidence of amblyopia was found among the poor readers, and they exhibited a greater average amount of amblyopia in the left eye only. The average amount of amblyopia in the right eye only and in both eyes was the same in each group.

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# ANGIODIATHERMY OF THE LONG POSTERIOR CILIARY ARTERIES AND ITS USE IN THE TREATMENT OF GLAUCOMA\*

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In 1890 Wagenmann<sup>1</sup> carried out his classical experiments in which he studied the effects of cutting the ciliary arteries of rabbits. Among other things, he found that a marked hypotony which persisted for several days developed when only one long posterior ciliary artery was cut. Since the tonometer had not been perfected at that time, he made no effort to carry out tension studies nor did he suggest that such a procedure might have any practical value. The present study, therefore, was undertaken to compare the results following electrocoagulation of the long posterior ciliary vessels with those of Wagenmann and to learn whether or not such an operation can be applied to the problem of glaucoma in man.

## *Comparative anatomy of the long posterior ciliary arteries of man and rabbit*

In man the long posterior ciliary arteries arise from the ophthalmic artery, enter the sclera obliquely to either side and slightly above the optic nerve, and after pursuing an intrascleral course of from 3 to 7 mm. enter the suprachoroidal space, where they course forward in the horizontal meridian to the ora serrata (Fuchs<sup>2</sup>). Here they bifurcate, pass forward alongside the ciliary muscle to its anterior border, and then proceed inward to form the greater arterial circle

(Leber<sup>3</sup>). The ring is completed by anastomotic vessels which course between the arms of the bifurcation. In rare instances the vessels course through the muscle substance, and at such times can be found between the meridional and circular fibers, but in the majority of cases the vessels pass not through the substance of the muscle but externally alongside of it (Maggiore<sup>4</sup>).†

From the greater arterial circle vessels are given off to the iris, ciliary body, ciliary processes, and anterior choroid. In addition to the long posterior ciliary arteries, the greater arterial circle receives as tributaries the anterior ciliary arteries, which pass through the sclera in the region of the rectus-muscle insertions.

The long posterior ciliary arteries of the rabbit have a somewhat different origin from that of man. The temporal vessel arises from the external ophthalmic artery, a branch of the internal maxillary artery, while the nasal artery arises in part from the external ophthalmic artery but also receives a small twig from the internal ophthalmic artery (Davis,<sup>6</sup> Krause<sup>7</sup>). Both arteries run slightly below the horizontal meridian and enter the sclera about 2 mm. posterior to the equator. Here they run superficially until they turn deeply inward to disappear some 2 mm. from the limbus. After disappearing from view each vessel bifurcates, giving rise to a superior and inferior branch which form the greater arterial circle. From this vessel, as in man, branches are

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† Fortin<sup>5</sup> teaches that the converse holds true—that is, that in the majority of cases the vessels pass through the muscle—but his teachings are at variance with those of other anatomists.

given off to supply the iris, ciliary processes, and anterior choroid (Baurmann<sup>8</sup>). Thus it can be seen that the blood supply of the anterior uveal tract is similar in man and rabbit, and experiments carried out on the long posterior ciliary arteries of the rabbit should be applicable to man.

### METHODS

In all the experiments on rabbits except those in which cyclodiathermy was carried out, monopolar desiccating current was used. This was simply a matter of expediency, since by so doing the necessity of shaving the animals for application of the neutral electrode was eliminated. The current used was of such strength as to give a spark gap of about 1 mm. The Schiötz tonometer was employed in all tonometric determinations. Due to the fact that the corneal curvature of the rabbit is not the same as that of man and since the footplate of the instrument is made to conform to the curvature of the human cornea, a valid objection to the use of this instrument can be raised where absolute readings are desired. In these experiments this argument cannot be brought to bear, since, for the most part, tonometric readings of fellow eyes are compared, and tonometric determinations, at best, only approximate the true intraocular pressure. In those instances wherein a simple tension curve was plotted, the difference in tonometric readings are too large to be attributed to tonometric discrepancies. Before deciding upon the tonometer to be used, the Souder and Schiötz instruments were carefully compared. In our hands the Souder tonometer proved most inconsistent and it was given up in favor of the Schiötz instrument.

All operations on animals were carried out under nembutal anesthesia given intraperitoneally, 0.045 gm. of nembutal per kilo of body weight being used routinely. It was employed in a solution of 10-percent alcohol, in which each cubic centimeter contained 0.045 gm. of the drug. Where this proved insufficient, supplementary injections of the solution were made in the marginal ear vein until the desired state of anesthesia was reached. A 0.5-percent solution of pontocaine was instilled into the conjunctival sac. All operations were performed with the animal's head held immobile in a clamp. Sterile instruments were used, but no preoperative care was given the eye, nor was the animal draped. When tonometric readings were taken other than at the time of operation, 0.5-percent solution of pontocaine was used locally, the animal was mummified by wrapping in a towel and held firmly by an assistant so that the cornea was parallel to the floor.

### COAGULATION OF A SINGLE LONG POSTERIOR CILIARY ARTERY

A single long posterior ciliary artery of one eye was coagulated in each of six rabbits, the fellow eye being left untreated to serve as a control. Tonometric readings, observation with the corneal microscope, corneal sensitivity, and fundus studies were then carried out at appropriate intervals.

The conjunctiva was incised about 5 mm. from the limbus in the horizontal meridian (either anteriorly or posteriorly, depending upon whether the nasal or temporal vessel was to be treated). At first a speculum was employed, but it was found more expedient to have the lids retracted by the assistant with finger traction. Tenon's capsule was incised, and the anterior lip of Tenon's firmly grasped with Elschmig forceps. The artery could be identified at once, but in some instances before coagulation could be carried out the overlying rectus muscle had to be pushed aside with a strabismus hook. An Arruga detachment speculum was then introduced to obtain better exposure. After the vessel had been identified, coagulation with the desiccating current was carried out just anterior to the entrance of the vessel into the sclera and for a distance of 2 or 3 mm. A curved-needle electrode was used. Treatment was considered adequate when the blood column was interrupted and the treatment area turned a deep-gray color. Closure of the conjunctival wound was effected with a running silk suture in some of the first cases but later this was abandoned and the conjunctiva simply replaced. Rapid healing resulted in both instances (fig. 1).

*Results.* Tension was taken immediately before operation and at intervals postoperatively. Figure 2 shows a characteristic curve which illustrates the rapid fall in tension to about one half the preoperative level over a period of three hours.

Tension curves of control and treated eyes of the six animals are shown in figure 3. From these curves it is evident that the low tension continues for several days and in most instances is lowest between the second and fourth days postoperatively, after which it rises slowly to attain the

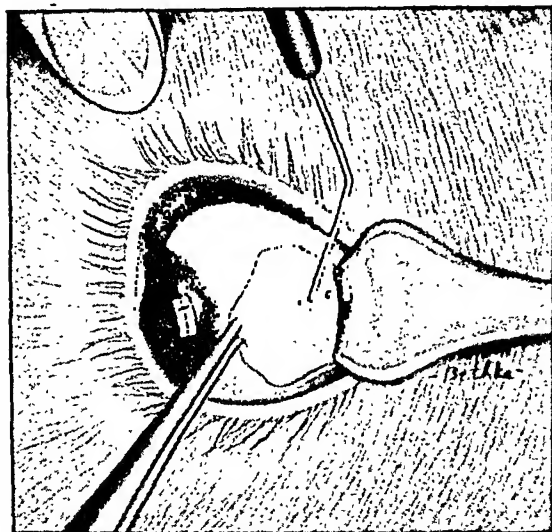


Fig. 1 (Guerry). Angiodiathermy in the rabbit.

preoperative level in about two weeks. In one instance (animal no. 213) the tension never fell to an unusually low level. Coagulation of either nasal or temporal vessel gave similar tension curves.

On the first postoperative day, slight edema of the corneal epithelium was noted by means of the corneal microscope, it being more pronounced in animal no. 208. Dilation of the peripheral ring vessel was also present. By the third day no pathologic changes were present other than slight fullness of the iris ring vessel, which persisted in three cases for more than two weeks. At no time was a positive Tyndall effect present nor were cells seen.

Corneal sensitivity was found to be definitely impaired in the quadrant adjacent to the treated area in three animals. This was determined by touching the cornea methodically with a firm bristle but it was felt that the results obtained were inconclusive.

The postoperative changes observed

with the direct ophthalmoscope differ somewhat in the pigmented and albinotic animals owing to the fact that in the pigmented animal the choroid is obscured by the pigment epithelium. For this reason the changes in the two types of animals are described separately.

In the albino, immediately after operation a whitish area some four or five disc diameters in size can be seen in the region where diathermy was carried out. At first a few partially filled choroidal vessels are present in the blanched area but these disappear leaving the area dead white. Fanning out in wedge shape anteriorly as far as can be seen is a blurred, striated area of yellowish hue. No change takes place until 72 hours have elapsed, when the treated area appears covered with a fine grayish net and the wedge-shaped area begins to regress. An occasional vessel can be seen at the periphery of the dead-

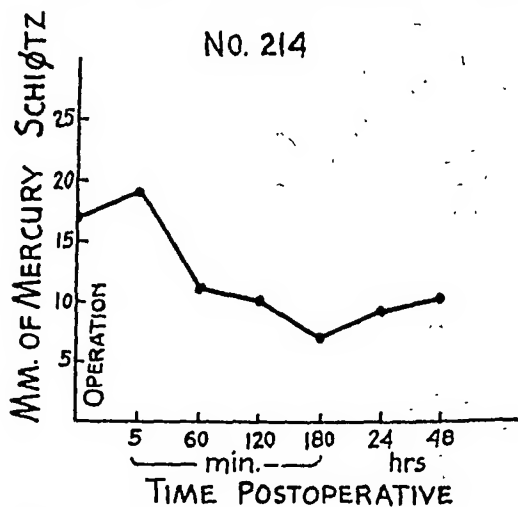


Fig. 2 (Guerry). Immediate postoperative tension fall following coagulation of a single artery.

white area after four days. After a week a small portion of the wedge-shaped area has disappeared and after two weeks only a small portion remains. After one month the area treated by diathermy appears as a small grayish-white avascular spot the size of which is dependent upon the area actually treated with diathermy.

In the pigmented animal a similar process is noted except for the fact that no choroidal changes can be observed. Pigment deposition begins around the

that of a large area showing destruction of choroid and retina and associated with dense pigmentation. The anterior region usually shows slight pigmentary stippling.

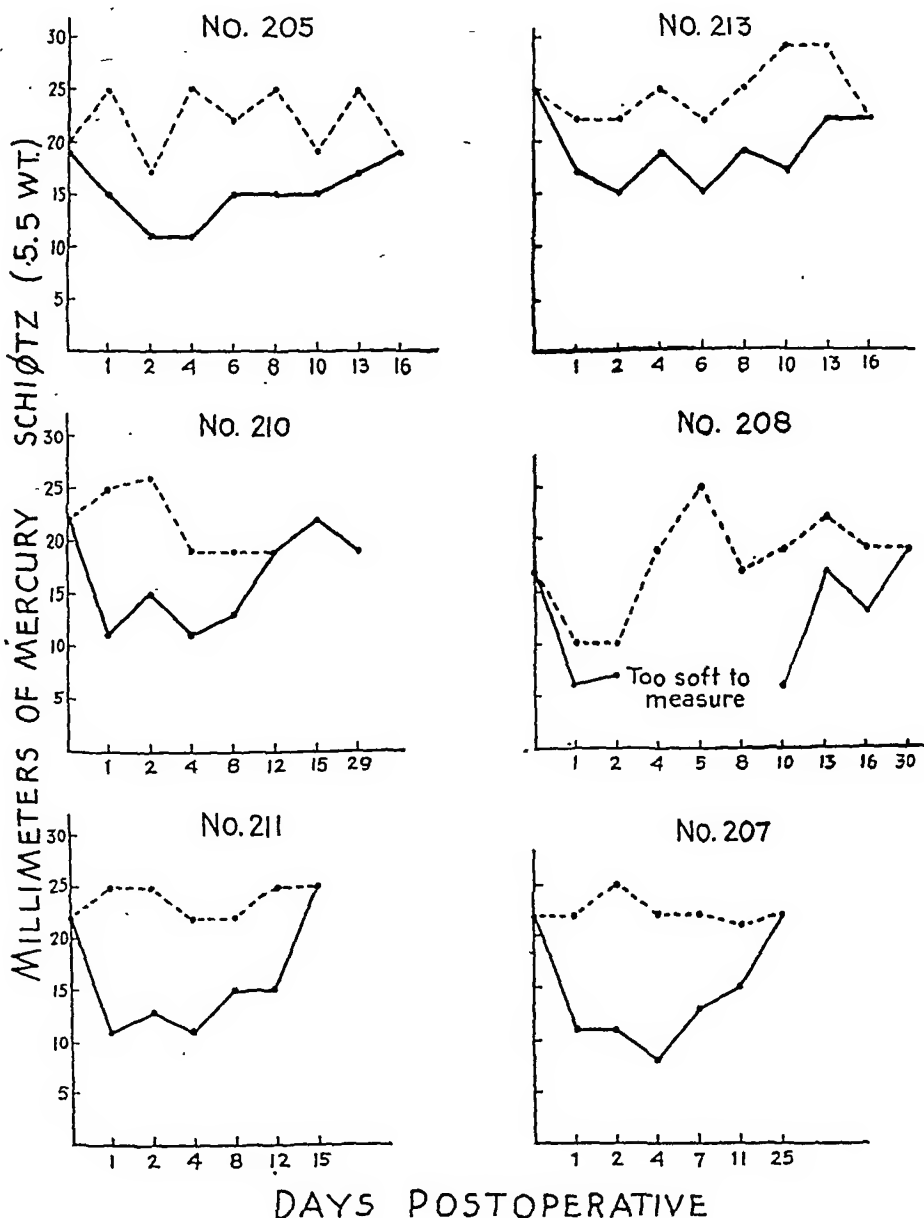


Fig. 3 (Guerry). Tension curve of control eyes and of eyes operated on following coagulation of a single artery. Broken lines represent control eyes, and solid lines treated eyes.

periphery of the treated area after one week. The peripheral sector disappears after three weeks. Pigmentation of the treated area continues until eventually the lesion shows changes which vary from a mild granular pigmentary disturbance to

At no time was there any evidence that the opaque zone was elevated.

*Discussion.* The corneal edema noted is due to the slight damage to the endothelial cells. In animal no. 208 the endothelium evidently suffered more than that

of the other animals. Slight decrease in the corneal sensitivity in the region adjacent to the treatment area should be expected, since the long ciliary nerve supplying that area runs close to the artery and in sections is found constantly involved with the artery in the eschar. A more sensitive method of testing might reveal decreased sensitivity in all cases. No attempt was made to evaluate the possible effects which might have been due to the destruction of motor fibers coursing in the long ciliary nerve, but it was felt that any such effect must be minimal.

The changes seen with the ophthalmoscope in the treated area are due to an actual coagulation of choroidal and retinal elements followed later by necrosis with complete destruction of architecture and finally fibrosis. Anteriorly a disintegration of the neuroepithelial elements associated with edema takes place, giving rise to the ophthalmoscopic picture noted. This change is apparently caused by the interruption of the blood flow through the anterior choroidal vessels.

Wagenmann first tenotomized the tendon of either the internal or external rectus muscle, depending upon which artery was to be cut, placed an enucleation spoon behind the globe, which was pulled forward and rotated until the ciliary vessels could be seen, and then cut the long ciliary vessel, which presented, with scissors. Hypotony developed and was thought to be lowest shortly after operation. There was no change in corneal sensitivity. The fundus changes noted resembled those seen following angiodiathermy in the region anterior to the treatment zone. In his cases, however, at least one half of the retina was involved, the region being confined to that side on which the artery had been severed.

The explanation for the more extensive retinal involvement in Wagenmann's ani-

mals must be attributed to the different techniques employed. It is not unlikely that at the time the long posterior artery was cut some of the short ciliary vessels might also have been injured. Since in the rabbit these arteries supply the posterior part of the choroid the overlying retina would be affected in that region as well as anteriorly.

#### COAGULATION OF BOTH LONG POSTERIOR CILIARY ARTERIES

Both long posterior ciliary arteries in each eye of six rabbits were coagulated by the same technique employed before and the same studies were carried out.

*Results.* In all cases an immediate tension drop similar to that shown in figure 2 was noted. Five eyes, in which the cornea remained grossly clear the day following operation, followed a course comparable to those in which only one vessel was coagulated. In two eyes, wherein the corneas showed slight gross clouding 24 hours postoperatively, the tension curve followed that of rabbit no. 208 of figure 3. In the remaining five eyes, the corneas of which showed gross clouding 24 hours after operation, the tension was too low to register and remained so, the eyes becoming phthisical after a time.

In the five eyes wherein the corneas were grossly clear, slight corneal edema was present for two days postoperatively. A slight Tyndall effect was also present for one week and rapidly moving cells were noted for a period of four or five days. No synechiae formed, and iris injection was limited to slight fullness of the peripheral ring vessel.

Considerably more corneal edema, which persisted for five or six days, was noted in the two eyes showing slight gross clouding. These eyes also showed a moderate Tyndall effect and slight but definite deep stromal clouding in the nasal and temporal sectors. Numerous rapidly

moving cells were present. The stromal clouding disappeared after 4 to 6 days and the Tyndall effect after 10 to 12 days.

Twenty-four hours after operation there was marked corneal edema and dense opacification of the entire thickness of the stroma in the nasal and temporal sectors of the five eyes in which pronounced corneal clouding had been noted. This corneal clouding spread centrally from the nasal and temporal sectors where it began about 10 hours after operation. With a fine slit the cornea appeared to be twice as thick as normal, the thickening being most pronounced peripherally. The Tyndall effect was marked, and in the albino animals, numerous slow-moving cells were present, while the pigmented animals showed in addition large pigment flecks on the endothelial surface as well as fine pigment granules dispersed throughout the aqueous. Occasional posterior synechiae were present. After 48 hours no detail could be made out because the opacification of the cornea had progressed until it had become uniformly opaque. Thickening had increased until now the cornea was at least three times its normal thickness. These changes resembled those seen in parenchymatous keratitis of man and resembled this condition even more strikingly when, on the fifth to sixth day, numerous fine brushlike vessels began to invade the stroma from the limbus. These vessels progressed until after two or three weeks only a small central area, about 5 mm. in diameter, remained vessel free. At this stage the cornea assumed a striking beef-red color, the center alone remaining milky white. After this peak vascularization had occurred, the vessels began to regress and the clouding to disappear. After two months the vessels had disappeared to gross inspection and the cornea had cleared considerably. The globe during this time became markedly shrunken and through the yellowish

tinted, moderately clear cornea, the anterior chamber was seen to be absent, the iris atrophic, and the lens cataractous. The corneal changes are shown in the series of pictures contained in figure 4.

In these animals an attempt was also made to study the corneal sensitivity. In two cases presenting clear corneas, sensitivity was perhaps slightly impaired in the nasal and temporal sectors, and in one instance perhaps in the nasal region. Sensitivity was definitely reduced throughout the entire cornea in all of the corneas which became opaque. The length of time this diminution in sensitivity persisted is not known, but in one instance after a year, when the globe had become completely phthisical, corneal sensitivity appeared to be normal.

The fundus changes observed followed a course similar to those noted when only one vessel was coagulated. Corneal clouding precluded fundus examination in some of the cases, but even in these instances, as long as an examination could be made, the process was found to be essentially the same.

*Discussion.* In those instances wherein the cornea remained grossly clear and the tension curve followed the pattern seen after coagulation of a single artery, the changes brought about by operation must still be minimal. The fact that a Tyndall effect, along with cells in the aqueous, was present indicates that tissue damage was somewhat more pronounced in those eyes than in those wherein only the one vessel was coagulated. Why these eyes should remain relatively unhurt by a procedure which in other eyes results in extreme tissue destruction and phthisis, is best explained in one of two ways: either they possess a singularly extensive collateral blood supply to the greater arterial circle, or, and this is more probable, only a partial or temporary obliteration of one of the long posterior ciliary



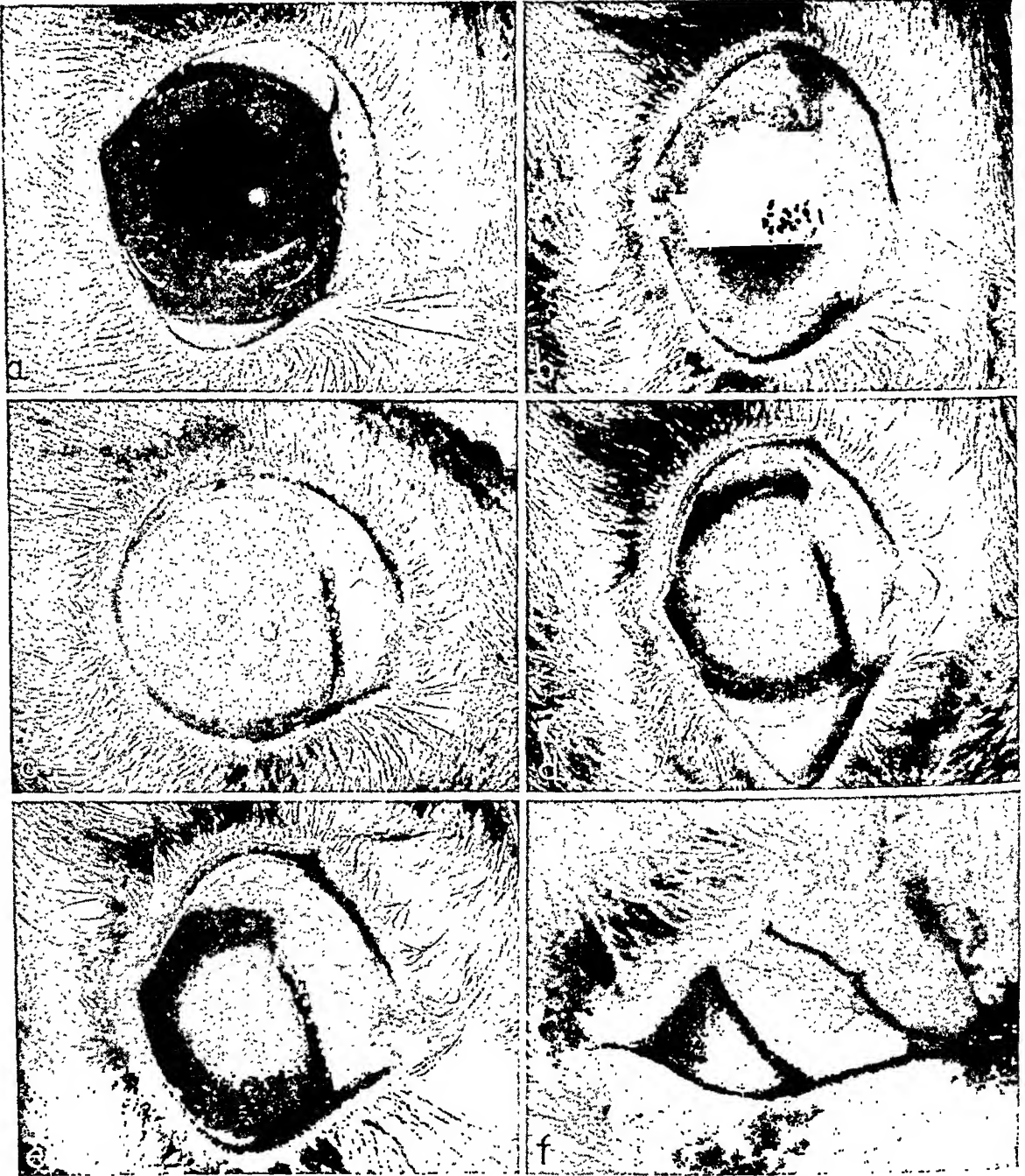


Fig. 4 (Guerry). Corneal changes after coagulation of both arteries. a, the eye before operation; b, 24 hours postoperative; c, 4 days postoperative; d, 9 days postoperative, beginning vascularization; e, 18 days postoperative, peak of vascularization; f, 1 year postoperative, phthisis.

vessels was effected by the diathermy. In those eyes wherein slight gross clouding of the corneas occurred it seems logical to presume that still more tissue damage resulted from the operation but not enough to give rise to actual destruction; hence the increase in Tyndall effect, number of cells in the aqueous, and the more

marked hypotony. When marked opacification of the corneas occurred the tension was reduced to extremely low levels because of complete or relatively complete destruction of the ciliary processes, the dissolution of which gave rise to the tremendous amount of pigment seen free in the aqueous and deposited over the

surface of the endothelium. In these eyes the corneal thickening came about probably as a result of corneal imbibition of aqueous following severe damage done the endothelium by the quantitative and qualitative alteration of the aqueous. The diminution of corneal sensitivity in the eyes wherein marked opacification occurred may be attributed to the great corneal swelling that must result in undue pressure on the nerves.

Complete opacification of the corneas and phthisis bulbi resulted in most of the cases in which Wagenmann cut both long posterior ciliary arteries and many of the short ciliary vessels. The technique he employed was similar to that used when only a single artery was severed. He also described the vascularization of the cornea, which he likened to interstitial keratitis. In several of his cases corneal ulcers developed, panophthalmitis, and finally complete destruction of the globe. The fundus changes that he observed before corneal clouding obscured the picture, were much more pronounced than those seen after coagulation of both vessels. Shortly following operation, he found the retina had become whitened, the process beginning anteriorly and progressing rapidly until the entire retina had become involved. Some hours later, the retina became folded, giving rise to a condition which he described as resembling "brain gyri." The process could not be followed beyond this stage because of the marked corneal clouding.

In Wagenmann's animals these changes which far surpass any seen following coagulation of both long ciliary vessels, can only be attributed to the cutting, not only of those vessels, but also of a great portion of the short ciliary vessels, the latter of which supply all of the choroid posterior to the equator. The blood supply of the entire uveal tract was thus reduced

to an insignificant trickle which was insufficient to prevent phthisis.

#### MICROSCOPIC PATHOLOGY

In order to study the pathologic changes microscopically, the following procedures were carried out:

(A) A single long posterior ciliary artery was coagulated in each eye of eight rabbits by the same technique. At intervals of 24 hours, 72 hours, 2 weeks, and 2½ months, two animals were killed by a blow on the head, the eyes enucleated, fixed in Zenker's solution, and embedded in celloidin. Two eyes were then sectioned serially in the horizontal meridian and the other two in the coronal meridian through the treated areas.

(B) Bilateral coagulation of both long posterior ciliary arteries in eight rabbits was also carried out and the same method followed as with the preceding eight animals. The sections were stained by van Gieson's or modified Mallory technique.

*Results.* Twenty-four hours after coagulation of a single artery, the changes found microscopically were minimal. Slight dropsical swelling of the endothelium was present and there was a faint trace of fibrinous material in the anterior chamber. The iris on the side which had been operated on showed slight congestion, particularly of the greater arterial circle. The ciliary processes of the treated side were moderately congested and the ciliary endothelium appeared slightly indistinct, the changes resembling those seen in early cloudy swelling. In the treated area the retina and choroid were destroyed, and for a considerable distance anterior and posterior to this area the choroidal vessels were markedly congested. A few polymorphonuclear leukocytes were found in the retina and choroid adjacent to the treated area. The retina anterior to the treatment area

showed disintegration of the neuroepithelial layer, and some disturbance of the pigment layer, as shown by poor staining of the nuclei. After four days the dropsical swelling of the endothelium had disappeared. A small amount of fibrinous material could be seen in the anterior chamber and scattered over the endothelium. The iris was slightly more congested on the treated side whereas the ciliary processes were much more congested and the ciliary epithelium much more indistinct than at the 24-hour stage. In the treatment area the retina and choroid were destroyed and the sclera showed necrotic changes. The choroidal vessels were moderately dilated anterior and posterior to the treatment area, while anteriorly the retina revealed the same disintegration of the layer of rods and cones. The limbal vessels on the treated side were slightly congested as compared with those of the untreated side. Between the ciliary processes in one globe a small amount of fibrinous material was present. After two weeks there was only a faint trace of fibrinous material in the anterior chamber, and the endothelium was intact. The ciliary processes on the treated side showed slight congestion whereas the changes noted in the retina anterior to the treatment areas were less pronounced. Two-and-one-half months after operation the anterior chamber still contained a small amount of fibrin. There was slight depigmentation of the pigment epithelium of the iris and ciliary processes on the treated side, and the retina was found to show the same changes as at earlier intervals in the area anterior to the treatment zone.

In the series of animals wherein both arteries were coagulated, eight eyes were found to show marked opacification of the cornea, one eye moderate clouding, and seven eyes no clouding 24 hours after operation. The pathologic changes

observed were found to vary in intensity, the most marked changes being seen in those eyes having the intense corneal opacification, and minimal changes being noted in the eyes devoid of gross corneal changes.

After 24 hours in an eye which had shown gross corneal opacification, the corneal epithelium was found to show an irregularity in thickness, the peripheral portions being reduced to a thin layer only two cells thick. Slight dropsical swelling was present in the endothelial cells, the nuclei of which stained poorly. The anterior chamber was shallow and almost filled with fibrinous material, cellular debris, and pigment clumps. The posterior surface of the iris had been completely denuded of its pigment epithelium, which lay roundabout in scattered clusters or as free granules. The ciliary processes were necrotic and naked, the epithelium and pigment layer having undergone complete dissolution. On one side between the ora serrata and the treatment area, the retinal architecture had been completely destroyed whereas on the opposite side, the neuroepithelial layer alone had become necrotic. The choroidal vessels were dilated both behind and in front of the treatment area. The changes noted in the treated area were similar to those where only one artery had been coagulated and consisted of complete destruction of the retina and choroid. The sclera in that region was also necrotic. Posterior to the treated areas the retina was not impaired.

In another eye which had shown moderate corneal opacification, the changes were less marked. Complete destruction of the ciliary processes was limited to one side and on that same side the retina between the ora serrata and treatment area was necrotic. Some destruction of the ciliary and pigment epithelium of the ciliary processes was seen on the

opposite side, but this was not pronounced. The retina on that side was intact. A moderate amount of fibrinous material was present in the anterior chamber, and the corneal endothelium showed slight dropsical swelling and indistinct nuclear staining.

Seventy-two hours after operation changes similar to those noted in the 24-hour stage were present but more advanced. The corneal endothelium was completely absent in places, and in other regions reduced to a reddish-staining granular layer (Mallory stain). A few remaining cells showed dropsical swelling. The cornea had become twice as thick as normal and the lamellae had become pale and swollen. The anterior chamber was shallow and filled with fibrin, while the iris had lost its pigment epithelium entirely. Only ghostlike traces of the ciliary processes remained. Pigment clumps were scattered through the aqueous and the region once occupied by the ciliary processes. Between the ora and treatment area the retina had undergone complete dissolution, but posteriorly it appeared normal.

An eye, the cornea of which remained grossly clear, after 72 hours showed changes comparable to those occurring after coagulation of only one artery. In this instance, pathologic changes were limited to slight dropsical changes of the corneal endothelium, the presence of a trace of fibrin in the anterior chamber, slight dispersion of the pigment of ciliary processes, and destruction of the neuroepithelial layer of the retina on one side between the ora and treatment area.

After two weeks the cornea was still twice as thick as normal and by now vessels could be seen throughout the anterior half of the stroma. The endothelium had disappeared completely and pigment flecks could be seen deposited directly on the naked Descemet's mem-

brane. The anterior chamber was filled with fibrin. The iris and ciliary processes had been reduced to pigmented fibrotic stumps (fig. 5). The lens was completely cataractous, and scattered throughout were Morgagnian droplets. The vitreous



Fig. 5 (Guerry). Section showing a portion of cornea, iris, ciliary processes, and lens two weeks after coagulation of both arteries. The cornea is markedly thickened, the anterior chamber contains much fibrin, the iris and ciliary processes are reduced to fibrotic masses with pigment scattered about, and the lens is cataractous.

cavity was filled with fine, pink-stained, wavy material (Mallory's stain) resembling skeins of fine silk. The retina was completely destroyed anteriorly, but in the posterior part, although the neuroepithelium had undergone necrosis, the remaining retina retained its architectural characteristics fairly well. The pigment epithelium of the retina was destroyed anteriorly.

In one eye at this stage the changes paralleled those noted in the other eyes,

the corneas of which had remained grossly clear.

Two-and-one-half months following operation the globe had become shrunk to about two thirds normal size. The corneal endothelium was markedly vacuolated and covered by a homogeneous red-staining layer (Mallory's stain). The cells contained pigment which might have been phagocytosed. The cornea had regained its normal thickness, and the vessels had become much reduced in size. The anterior chamber was almost completely obliterated by anterior synechiae and what little space remained was filled with fibrin. Posterior synechiae were present also, and the pupillary area was completely occluded. Iris and ciliary processes were reduced to pigmented fibrotic masses, and the anterior surface of the iris was covered with Descemet-like material. The vitreous cavity was filled with material similar to that noted at the two-weeks stage. The anterior portion of the retina was destroyed, but the posterior part showed only neuroepithelial damage.

*Discussion.* The pathologic changes occurring after the coagulation of a single long posterior ciliary artery are minimal. For the most part they are transitory and the eye as a whole suffers but little. The damage done the retina, both in the treated area and between that area and the ora serrata, and the destruction of the choroid in the region where diathermy was carried out, are the only lesions which fail to undergo a completely reversible reaction, and these persist as definite lesions.

Wagenmann found pathologic changes similar to those described above. He found that the endothelium of the cornea showed slight granular degeneration and poorly staining nuclei. The anterior chamber contained fibrin in moderate quantities and the iris on the affected side was congested. He also described changes

occurring in the neuroepithelial layer of the retina on the affected side as "loosening of the rods and cones." In some cases he found the vitreous to contain a small amount of fibrin. His studies following injection of gelatin into the carotid artery revealed that the iris and ciliary body on the side on which the artery had been cut were free from the injection mass whereas those structures were completely filled on the side that had not been operated on.

Following coagulation of both long ciliary vessels the changes noted in the different eyes vary tremendously. In half of the eyes complete destruction of the ciliary processes, necrosis of the iris, destruction of much of the retina, marked thickening of the cornea with vascularization, and finally shrinkage of the globe result. In an occasional case damage little more extensive than that noted when only one vessel was coagulated, occurred. In a little less than half of the eyes, the changes, though still marked, were not so extensive nor of such severity as to lead to phthisis. In these eyes only some of the ciliary processes became necrotic and only a small portion of retina was destroyed, these changes for the most part being limited to the structures of one side. In these cases collateral blood supply must be adequate or else one of the vessels must have been incompletely coagulated. Careful study of the treatment areas failed to reveal any patent lumen, but it must be understood that it is most difficult to determine what constitutes functional obliteration of a vessel seen in section.

The changes Wagenmann found after cutting both long posterior ciliary vessels, along with a large number of the short ciliary arteries, were similar to those seen following coagulation of both long ciliary arteries, although more pronounced. Extreme corneal thickening

with vascularization, destruction of the iris and ciliary processes, massive fibrinous exudation into both the aqueous and vitreous cavities, and complete destruction of the retina were usually found. In some instances where these changes were not so marked and where the globe did not become completely phthisical, he found the anterior ciliary vessels in-

*Method.* A single eye in each of three rabbits was treated by cyclodiathermy and immediately thereafter a single long posterior ciliary artery was coagulated. The three fellow eyes were treated only by cyclodiathermy and served as controls. Bipolar diathermy current was employed in this experiment. After shaving the animal a neutral electrode was applied. The tension was then taken and the conjunctiva incised 5 mm. from the limbus, the incision extending around the upper half of the globe. The conjunctiva was dissected down to the limbus

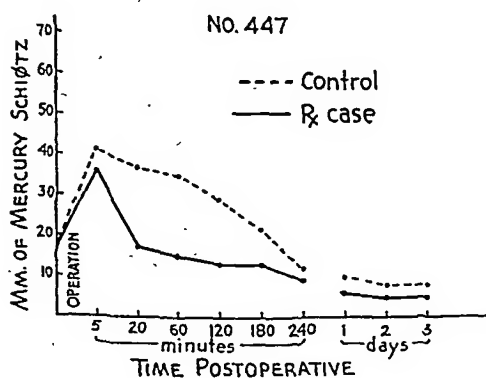
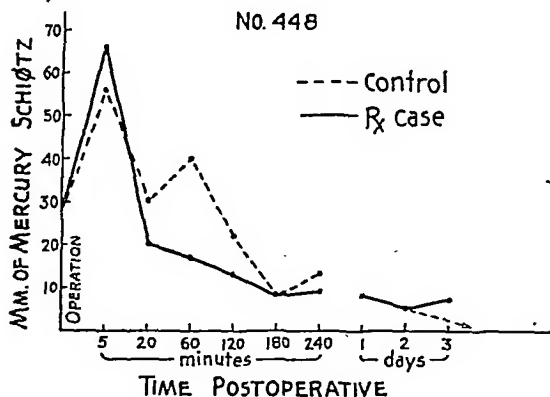
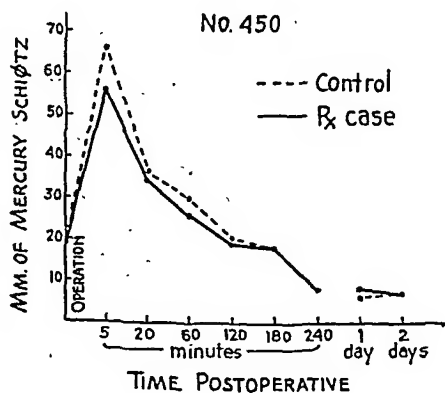


Fig. 6 (Guerry). Tension curves following cyclodiathermy and cyclodiathermy combined with angiodyathermy in rabbits. The broken line represents eyes in which only cyclodiathermy was carried out, the solid line those in which the combined operation was carried out.

creased in size and apparently newly formed vessels arising from the conjunctival vessels at the limbus. In his opinion these collaterals prevented complete phthisis even though marked tissue destruction did take place. Following injection of gelatin into the carotid, the iris and ciliary processes were found to contain none of the injection mass.

#### ANGIODIATHERMY AND CYCLODIATHERMY

To determine the effect of combined angiodyathermy and cyclodiathermy the following procedure was carried out.

and the sclera cleaned over this area. Non-perforating cyclodiathermy was carried out, the Walker diathermy unit being set at 35. A flat Weve electrode measuring 2 mm. in diameter was used, four applications of six seconds' duration being made, two to either side of the superior rectus muscle. The treated areas appeared dull gray following the diathermy. Immediately after cyclodiathermy a long posterior ciliary artery was identified and coagulated, the Larkin modification of the Lacarrère electrode being employed. The conjunctiva was then replaced and the tension taken at intervals. In the control eyes cyclodiathermy was carried out, as with the fellow eye, but the long posterior ciliary arteries were allowed to remain intact.

*Results.* In one animal (no. 450) the



tension of both eyes rose rapidly to strikingly high levels and then fell over a period of two hours to normal, the fall then continuing for another hour until one half the preoperative level was attained. Similar abrupt tension rises were noted in the eyes of animals no. 447 and no. 448, but in these animals the tension of the eyes in which the combined operation had been carried out fell much more rapidly to a hypotonic level. The tension curves for these animals are shown graphically in figure 6. In all cases the tension remained low for about two weeks and then began to rise slowly until the preoperative level was reached on the seventeenth day to the twenty-first day.

*Discussion.* Weekers and Weekers<sup>9</sup> have noted the postoperative rise and fall in nonperforating cyclodiathermy carried out in normal rabbit eyes. The sudden rise is explained by them as being due to an immediate-rapid dilatation of the uveal vessels. The fall, they contend, is due to an increase in absorption of the aqueous which has undergone considerable change in character. The explanation for the tension rise appears quite logical, but the explanation for the fall is highly unlikely. The more plausible explanation would seem rather to be a decrease in aqueous output due to the severe damage suffered by the ciliary processes.

In one animal (no. 450) the control and treated eyes followed a similar tension pattern but in two animals (no. 447 and no. 448) the tension fell much more rapidly in the eyes in which the combined operation had been carried out. This may mean that either the initial uveal dilatation was somewhat modified or else aqueous production was slowed down more rapidly than would be the case following cyclodiathermy alone. If angiodyathermy had been carried out prior to

cyclodiathermy this effect might have been more striking.

The fact that tension curves of control and treated eyes followed a remarkably similar pattern after the first few hours indicates that any effect angiodyathermy might have on the course of cyclodiathermy in these animals is transitory and limited to the first few hours. The return of tension to normal after three weeks would seem to indicate that either the ciliary processes are not destroyed in the treated region or else the remaining processes compensate by producing more aqueous.

#### ANGIODIATHERMY IN MAN

After carrying out the experiments previously described on rabbits, the effect of angiodyathermy of a long posterior ciliary vessel was studied in man. In two cases of absolute glaucoma an attempt was made to carry out coagulation of the temporal long posterior ciliary artery after first detaching the external rectus muscle. No attempt was made to locate the artery, but diathermy punctures were blindly staggered in the region of the equator over the supposed course of the vessel. In both cases the tension was not affected in the least. I then found, after observing several eyes at the time of enucleation, that the temporal vessel is usually obscured by the attachment of the inferior oblique muscle, whereas the nasal vessel is more prominent and can easily be identified, once the internal rectus muscle has been detached.

In view of these findings a new procedure was followed. Two-percent procaine hydrochloride was injected retrobulbarly and in the region of the internal rectus muscle. The conjunctival sac was flushed with 25-percent argyrol, 1:1,000 adrenalin solution, and 4-percent cocaine. The speculum was inserted, and



the conjunctiva incised over the region of the internal rectus muscle. This muscle was then mobilized on a strabismus hook, a double-armed silk suture passed through its tendon, and the tendon cut free from the globe. A traction suture was passed through the tendon stump and the globe widely abducted. An Arruga detachment speculum was inserted; the sclera cleaned thoroughly, and the artery identified. Coagulation was carried out posterior to the equator with the Larkin modification of the Lacarrère electrode. The electrode tip was set at 1 mm., and the coagulation carried out by making perforations over the visible course of the vessel. The setting on the Walker diathermy machine was 45. Identification of the long posterior ciliary artery proved to be the most difficult part of the procedure. If the eye was well abducted, however, and care taken to clean the sclera thoroughly so that it became glistening white, identification was easily accomplished. In an occasional case, at the time of enucleation, the actual entrance of the vessel into the sclera was observed. The technique employed is shown in an artist's drawing, figure 7.

#### CASE REPORTS

*Case 1.* P. T., an Italian man, aged 75 years, was admitted to the Eye Institute, November 30, 1943, with the complaint of severe pain in the right eye of two weeks' duration. One year before, the patient had noticed that the vision in the right eye had become poor, and occasional episodes of pain and redness had occurred. He consulted his family physician, and "drops" were prescribed which "made the eye worse." Light perception had not been present for at least six months. The patient was seen in the Vanderbilt Clinic, the diagnosis of absolute glaucoma in the right eye made, and enucleation advised.

At the time of admission the patient's vision was: right eye no light perception, and left eye 20/70, unimproved with lenses. The tension was: right eye 65 mm. Hg. and left eye, 19 mm. The left eye was normal except for incipient cortical lens changes. The bulbar and palpebral

conjunctiva of the right eye showed moderate injection. The cornea was very edematous and precluded detailed observation of other structures, but the pupil could be faintly seen fixed in mid-dilatation. There was no defect noted following transillumination. Following angiodiathermy, the cornea cleared. The iris was then found to be atrophic, bound down with posterior synechiae, and covered with newly formed

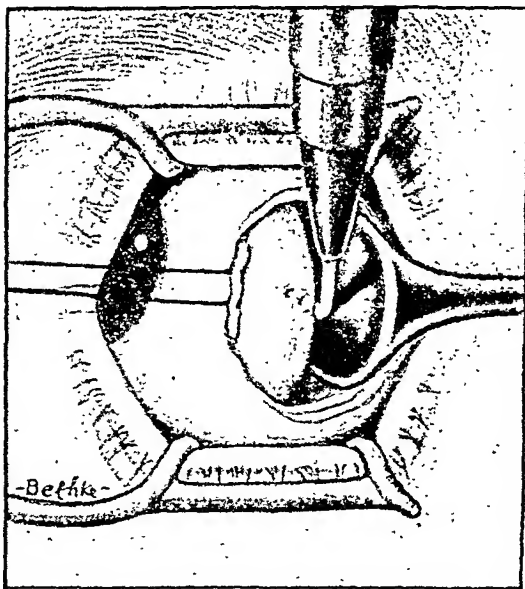


Fig. 7 (Guerry). Angiodiathermy in man.

vessels. A few old keratic precipitates were seen on the endothelial surface. The anterior chamber was very shallow but no cells nor flare was present. The lens was cataractous, and no fundus reflex could be obtained. Although the patient was admitted for enucleation of the right eye, angiodiathermy was carried out to study the effect on the intraocular pressure.

At operation on December 1, 1943, no difficulty was encountered in finding the nasal long posterior ciliary artery. It was coagulated through the sclera well behind the equator. Figure 8 illustrates the tension curve following operation. From this it is evident that the tension reached a low of 31 mm. Hg on the third day only to be followed by a moderate rise for several days and then another drop to the 31-mm. level. The cornea cleared on the second postoperative day and remained clear until the eighteenth day, when it was again found to be edematous. The eye was comfortable throughout the entire postoperative course even though the tension reached preoperative levels. Corneal sensitivity was markedly impaired before the operation and no change was noticed

postoperatively. The patient was discharged on the nineteenth day, and though the tension remained high and the cornea cloudy, he was comfortable until February 1, 1943, when pain became troublesome. The eye was enucleated February 2, 1944, and pathologic studies are to be carried out.

Case 2. C. B., a colored man, aged 68 years, was admitted to the Eye Institute on December

anterior chamber was completely absent below and shallow above. No fundus reflex could be seen. Transillumination revealed no defect. On December 28, 1943, angiodiathermy of the nasal vessel was carried out, the vessel being coagulated well behind the equator. The tension the next day had fallen from 100 mm. Hg to 17 mm., and the cornea had cleared completely. The upper and lower lids showed some edema, which was found to be due to sensitivity to sulfathiazole ointment employed at the time of operation. The postoperative tension curve is shown in figure 9. From this curve it is evident that the tension remained low for nine days and then gradually rose over a period of 10 days to the preoperative level. Throughout this time, and until January 28, 1944, the patient was comfortable. Pain then developed and the eye was enucleated on February 1, 1944. Pathologic studies are to be carried out. During the time the tension remained low the cornea became clear and remained so until the tension began to climb. The reaction fol-

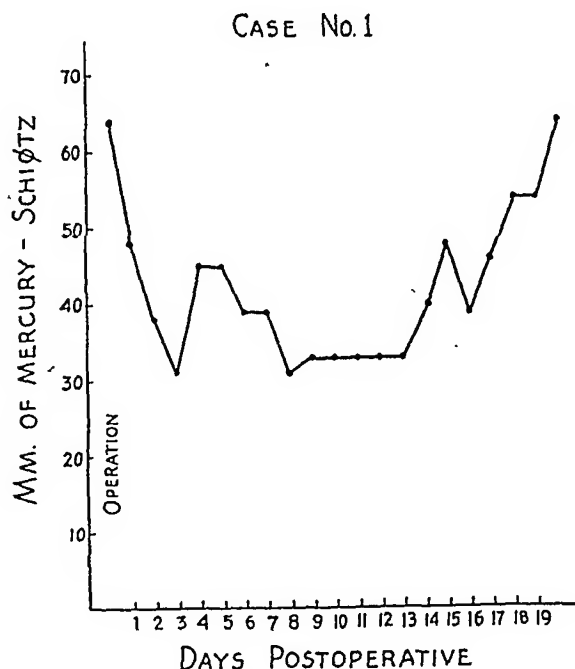


Fig. 8 (Guerry). Tension curve following angiodiathermy of nasal long posterior ciliary artery.

27, 1943, with the diagnosis of absolute glaucoma of the right eye.

In February, 1942, an intracapsular extraction, left eye, was carried out following which the patient obtained 20/30 vision with correction. An extracapsular extraction was performed on the right eye in July, 1942. After operation the eye became irritable, and a dense secondary membrane developed. Glaucoma then set in, and in spite of treatment all light perception was lost. The tension remained high but for the most part the patient was comfortable. Angiodiathermy of a long posterior ciliary vessel was suggested as a possible means of lowering the intraocular pressure.

At the time of admission the patient was found to have vision of 20/30 in the left eye with correction, and no light perception in the right eye. Except for aphakia with complete iridectomy, the left eye was normal. The tension in the right eye was 100 mm. Hg and the cornea was extremely edematous. Through the corneal haze, the pupillary area was seen to be occluded by a dense whitish membrane, and the

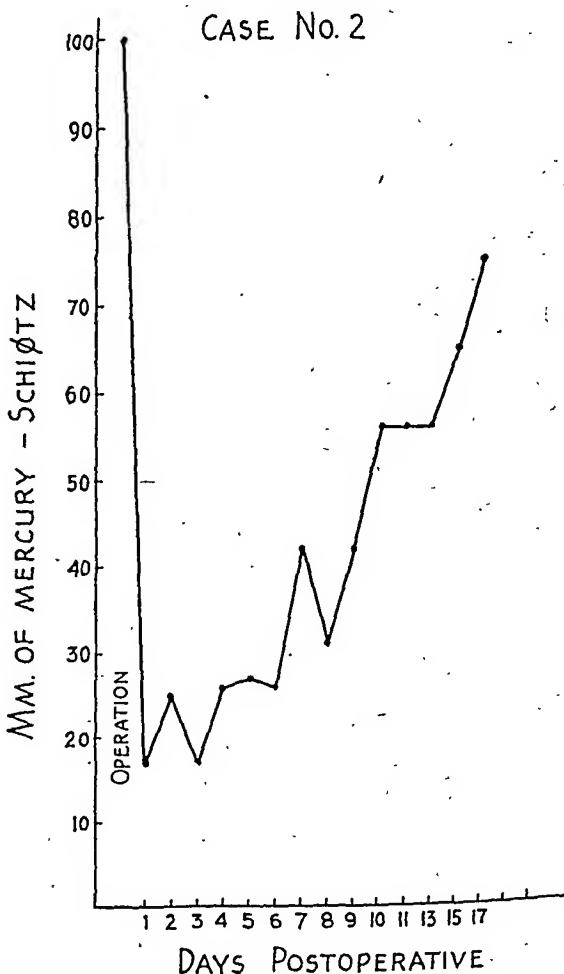


Fig. 9 (Guerry). Tension curve following angiodiathermy of nasal long posterior ciliary artery.

lowing the use of sulfathiazole ointment disappeared after four days.

**Case 3.** L. R., a 48-year-old Jewish man, was admitted to the Eye Institute September 3, 1943, for treatment of bilateral secondary glaucoma. His vision had been poor in the left eye for 15 years following a blow in that eye from a bowstring. Vision in the right eye had become impaired during the past two or three years during which time he was found to be suffering from moderately severe diabetes. His diabetes was controlled by 40 units of protamine zinc insulin daily.

When first seen in the Vanderbilt Clinic on March 2, 1943, he was found to have vision of 20/70 in the right eye and 4/200 in the left eye, advanced diabetic retinopathy in both eyes, and subcapsular axial lens changes in the right eye. Although a guarded prognosis was given the patient asked that the lens of the right eye be extracted. An extracapsular extraction was performed on May 7, 1943, some two months after an uneventful preliminary iridectomy. The patient's postoperative course was smooth, but with correction, vision of only 20/200 was obtained in the right eye. In early July secondary glaucoma set in. This failed to respond to either miotics or mydriatics, and on July 16th cyclodialysis was carried out over the upper temporal quadrant. The postoperative course was uneventful, but the tension remained high. In August the tension was found to be elevated in both eyes, and in spite of intensive treatment with miotics remained uncontrolled. Acute glaucoma then developed in the left eye on September 3d, necessitating admission for treatment.

At the time of this admission the patient's vision was light perception in the right eye and 7/200 in the left eye. The tension was 48 mm. Hg in the right eye and 65 mm. in the left eye. Examination of the right eye revealed moderate corneal edema, an operative coloboma at the 12-o'clock position, rubeosis iridis, and a good fundus reflex but no detail. The cornea of the left eye was found to be very edematous, the pupil irregular and fixed in mid-dilation. Fundus detail was somewhat obscured but marked diabetic changes—such as, innumerable deep and superficial hemorrhages, edema of the retina, papilledema, areas of hard and soft exudate, and marked phlebosclerosis—could be seen. Intense miotic therapy was instituted without improvement, and on September 10th, perforating cyclodiathermy (Vogt type) was carried out over the lower one third of the left globe, some 20 perforations being made. Following this the tension rose considerably and the patient complained of severe pain, controlled by frequent hypodermic injections of morphine sulfate. Since the tension remained elevated in both eyes, cyclodia-

thermy was advised. Nonperforating cyclodiathermy of both eyes was carried out on October 1, 1943. The nasal long posterior ciliary artery of the right eye was coagulated at the same time.

Applications (nonperforating) with the Weve electrode were made over the ciliary body of the right eye, from the 1:30- to the 5-o'clock position. After the internus had been detached, the long posterior ciliary artery was identified and thoroughly coagulated just anterior to its

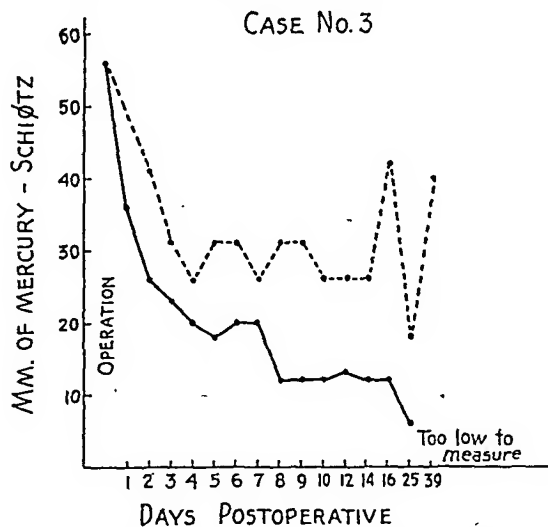


Fig. 10 (Guerry). Tension curves following angiodyathermy and combined angiodyathermy and cyclodiathermy. The broken line represents the eye in which cyclodiathermy alone was carried out, the solid line, the eye in which the combined operation was employed.

entrance into the sclera. The strength of the current used for cyclodiathermy was that advocated by Albaugh and Dunphy,<sup>10</sup> that is, setting the Walker diathermy machine at 35, with each application eight seconds in duration. Applications were then carried out from the 11- to the 2-o'clock position on the left eye. The resulting tension curves are shown in figure 10.

**Discussion.** In the two human cases of absolute glaucoma in which the nasal long posterior ciliary vessel was coagulated, a significant drop in tension occurred. The drop in case 1 reached its lowest level on the third postoperative day only to rise somewhat for two days. This was then followed by a fall on the fifth postoperative day, the tension then remaining low until the fourteenth postoperative day when it began to rise.

The préoperative level was reached on the nineteenth day after operation. The tension curve is not unlike that seen in the experimental animal following the same operation. The marked drop in tension in case 2 over a period of 24 hours to about one-fifth the préoperative level is striking. The gradual rise thereafter to préoperative level also parallels that seen in the experimental animals. No reason can be given for the more pronounced tension fall seen in case 2. In neither of these cases could the fundus be seen. Therefore, no fundus changes could be observed. Corneal sensitivity was markedly impaired before operation in both cases and no change was noted postoperatively.

Many cases following nonperforating cyclodiathermy, and particularly those of hemorrhagic glaucoma, develop an increased tension with intense pain postoperatively, and the tension falls to a low level only over a period of weeks. It was felt that in these cases, and perhaps in all cases of cyclodiathermy, this tendency to an initial tension rise might be controlled by angiodiathermy carried out at the same time.

In case 3, bilateral hemorrhagic glaucoma was present in a diabetic, and penetrating cyclodiathermy had been carried out over the lower one third of the left globe three weeks before. This had given rise to an increase in tension with severe pain. Cyclodiathermy of nonperforating type was then carried out in both eyes over an area of equal size. In the right eye the nasal long posterior ciliary artery was coagulated after cyclodiathermy had been carried out over the nasal region. From the tension curves it is evident that the tension fall following the combined operation was much more rapid and marked than in the eye wherein cyclodiathermy alone was em-

ployed. At the present time tension in the left eye has again become elevated, while that of the right eye is still too low to measure. The right eye has remained comfortable whereas the left is painful at times. Only light perception remains in either eye. Obscuration of the fundi by vitreous opacities prevented observation of the changes taking place. In this case also, corneal sensitivity was definitely impaired both before and after operation.

It may be suggested that the tension fall noted in these cases is not due to actual coagulation of the long posterior ciliary artery but instead to the perforation caused by the electrode at the time of operation. This argument can easily be disposed of by citing the two cases in which blind perforations caused absolutely no change in the tension. Further evidence to refute this is adduced by the fact that where posterior sclerotomy is performed with a resulting vitreous fistula, tension is rarely lowered for a period of over four or five days.

### CONCLUSIONS

From these studies it seems evident that a transitory reduction of tension can be brought about in the human eye and in the rabbit eye by coagulation of a single long posterior ciliary artery. This is an innocuous procedure in the rabbit, and apparently in the human, although the human cases are too few in number to allow any definite conclusions to be drawn.

Angiodiathermy of a single long posterior ciliary artery should be of value in reducing the intraocular pressure in such cases wherein other operative procedures are contemplated and the pressure cannot be brought to a safe préoperative level. In other words, it should be a safer procedure than posterior scler-

rotomy, since the globe is decompressed more slowly and the infection hazard is much less.

When employed in conjunction with cyclodiathermy, angiodiathermy should prevent the initial tension rise that often proves so distressing.

These studies give added support to the teaching that the horizontal meridian should be carefully avoided during diathermy operation for retinal detachment. In case a single long posterior ciliary artery is inadvertently coagulated, hypotony results during the very interval when a normal or slightly elevated tension is desirable. If the experiments on rabbits can be applied to man, coagulation of both long posterior arteries might result in phthisis.

#### SUMMARY

1. The results of coagulating the long posterior ciliary arteries of rabbits, sing-

ly and together, are compared with those obtained by Wagenmann after cutting these vessels.

2. Coagulation of a single long posterior ciliary artery was found to reduce the intraocular pressure in both the rabbit and human for a period of about two weeks. The procedure is relatively harmless.

3. Coagulation of both long posterior ciliary arteries in the rabbit resulted in phthisis bulbi in 50 percent of the cases.

4. The procedure is suggested as a rational substitute for posterior sclerotomy, and as a method of preventing the initial tension rise seen so frequently after cyclodiathermy.

5. The technique of coagulating by diathermy the nasal long posterior ciliary artery in the human is described.

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# THE PRODUCTION OF LENS SENSITIVITY IN RABBITS BY BRUCELLA INFECTION\*

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In an earlier report<sup>1</sup> it was shown that rabbits could be sensitized to lens substance by the potentiating effect of staphylococcal toxin. This sensitization was shown by cutaneous reactions to solutions of beef, pig, human, and rabbit lens; also by marked anaphylactic intraocular reactions when lens substance was liberated by needling the lenses of these sensitized animals. In applying these observations to an understanding of lens sensitization in humans the suggestion was made that a low-grade infection introduced into the lens at the time of extracapsular extraction and the coincident absorption of bacterial products and lens produced the sensitivity. This hypothesis was not subject to confirmation in the rabbit because of the varying intraocular reactions to staphylococci.

More recently, in studying the ocular pathology produced by brucella,<sup>2</sup> the idea suggested itself that this organism might be used to test the soundness of the aforementioned hypothesis. A strain of brucella, isolated from a mare with periodic ophthalmia, was used throughout these studies. The organism was first introduced into the anterior chamber of the eyes of rabbits. It produced varying amounts of intraocular inflammation, ranging from a destructive panophthalmitis to mild chronic iritis that eventually cleared up with few or no sequelae. Later, inoculations were done by lightly scratching the cornea with an infected 25-G. needle. At the end of 48 hours all eyes appeared normal. After that time and up to seven days later about 75 percent of the

animals developed iritis of varying intensity and clinically resembling periodic ophthalmia in horses. It is interesting that this observation challenges the strongly held opinion that organisms cannot pass the relatively unbroken cornea without inducing destructive abscess formation. These results are cited briefly to orient the reader as to the pathologic possibilities of brucella.

The following experiments were made to test the validity of this hypothesis. Six rabbits were injected in the right eye by the following method: A 25-G. needle attached to a syringe was first dipped into a 48-hour broth culture of brucella. This needle was then introduced into the anterior chamber, and the aqueous, under its own pressure, was allowed to flow into the syringe. The needle was then inserted into the lens and the syringe emptied. This technique produced marked lens damage, rupturing the lens and expelling considerable lens substance. Within 24 hours there was marked intraocular inflammation in all eyes, which continued for about three weeks, when all the eyes were quiescent. Each week after the initial inoculation, the animals were tested for lens sensitivity by the cutaneous injection of bovine lens solution, 1:100. There was no real evidence of cutaneous sensitivity. Occasionally a small nodule could be felt on the following day, but these were definitely doubtful reactions. All of the rabbits developed positive cutaneous reactions to brucellin, a substance analogous to Deny's bouillon filtrate. Three of the rabbits developed precipitin titers for lens extract as high as 1:40.

After four weeks the lenses of the left eyes were needled as has been described,

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except that the needle was sterile. Four of the rabbits developed violent anaphylactic intraocular reactions within 24 hours. Sections from eyes removed at various intervals showed histologic pictures similar to those seen in the eyes sensitized by the action of staphylococcal toxin. There was no suggestion of brucella infection in these eyes. Parenthetically, it is admitted that this infection does not produce a particularly characteristic histologic picture. Six normal rabbits were needled in parallel with the aforementioned animals and showed only the usual traumatic cataracts.

This experiment was repeated on 12 rabbits with the same essential technique and results, except that the needlings were done eight weeks after the original inoculations and the rabbits were observed at varying intervals up to one year. The same violent inflammatory reactions were

observed within 24 hours after needling the normal left eye, and at the end of one year all of the left eyes showed evidence of the previous trauma in well-defined cataracts, posterior synechiae, and scarred irises.

At irregular intervals preceding and following the needlings of the left eye, blood cultures for brucella were made, with entirely negative results. This was done to answer the obvious criticism that organisms, circulating in the blood, localized in the damaged lens.

If the results of the blood cultures rule out this chance, these experiments suggest that lens sensitization can be produced by infecting a damaged lens. They do not suggest that brucella is the offending organism, although, from the recent findings of the role of this organism in human ocular disease, they may occasionally play the sensitizing role.

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# OPHTHALMOSCOPIC CLASSIFICATION OF HYPERTENSIVE DISEASES\*

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Richard Bright,<sup>4</sup> over 100 years ago, described hypertension associated with kidney disease, and his concept of hypertension existed until 1896, when Clifford Albutt<sup>1,2</sup> described hypertension as being due to some vasoconstricting mechanism which led to arteriolar sclerosis and was not primarily associated with kidney disease. Janeway,<sup>12</sup> in 1913, stated he believed that the disease was one of the small blood vessels and that the kidney disease was a secondary manifestation. This belief was generally accepted until 1932, when Goldblatt,<sup>9</sup> began various experiments on dogs and monkeys and found that, by constricting the renal artery on one side, he could produce hypertension resembling that occurring in man. He showed that the causative factor was ischemia of the kidney, the degree of hypertension depending upon the degree of occlusion of the renal artery. He demonstrated further that malignant hypertension could be produced by constriction of both renal arteries. Here again the degree of hypertension was dependent upon the degree of constriction, up to nearly total occlusion, for when total occlusion occurred, or when both kidneys were removed, no hypertension developed.

Tigerstad and Bergmann,<sup>18</sup> in 1899, discovered that extracts from the kidney contained a protein that would produce a

rise in arterial pressure. In 1939 Page<sup>16</sup> purified rennin and showed that alone it would not cause hypertension, but that there existed in the blood a rennin activator which, when combined with rennin, produced angiotonin. Angiotonin caused the vasoconstriction and was, therefore, responsible for the hypertension. The work of Page has demonstrated that there is formed in the blood an inhibitor substance which may be a valuable therapeutic aid in hypertension.

Since 1932 much work has been done on the hypertensive states, and considerably more is known concerning pathogenesis. Nevertheless no definite conclusions can be drawn from this knowledge, for there are many factors that may produce the same type of hypertensive disease.

Fishberg's conception is not conclusive, but seems to define the situation at present. "The concept of essential hypertension includes those cases of chronic hypertension which neither clinically nor anatomically can be demonstrated to have evolved from an antecedent inflammatory disease of the kidney or of urinary obstruction"—so that we have adopted the term "essential benign hypertension," but no definite classification has been accepted. The classification by Weiss<sup>23</sup> defines the various known groups, which he outlines as follows:

- I. Hypertension of organic vascular origin with renal ischemia:
  1. Congenital malformations

\* Read at the seventy-ninth annual meeting of the American Ophthalmological Society, at Hot Springs, Virginia, June, 1943.

- a. Coarctation of the aorta
  - b. Hypoplastic renal artery
  - c. Polycystic kidneys
2. Inflammatory vascular diseases
  - a. Glomerulonephritis
  - b. Pyelonephritis
  - c. Periarteritis nodosa
  - d. Arteritis—"rheumatic"
  - e. Disseminated lupus erythematosus
3. Degenerative vascular diseases
  - a. Arteriosclerotic occlusive lesions of the renal artery ("essential hypertension")
  - b. Renal arteriosclerosis ("essential hypertension")
- II. Hypertension of organic vascular origin without renal ischemia: Diffuse arterial and arteriolar sclerosis
- III. Hypertension of nonorganic vascular origin:
  1. Endocrine disorders
    - a. Pituitary dysfunction and neoplasms (Cushing syndrome)
    - b. Adrenal dysfunction and neoplasms (cortical and medullary)
    - c. Certain types of toxemias of pregnancy
  2. Nervous disorders
    - a. Cerebral trauma
    - b. Cerebral neoplasms
    - c. Poliomyelitis
    - d. Rare vascular diseases of the brain

This classification does not include malignant hypertension, which, we believe, should be in a separate classification, as it is, in our opinion, a disease entity.

The ophthalmic literature contains many articles concerning the ocular findings in the various hypertensive states, but here also the nomenclature and classification of diseases are very confusing. There would seem to be utter confusion in the minds of the ophthalmologists as to which of the various terms to

use, for in no section of this country is there a common language. There are certain terms that should be in universal usage, and we should attempt to adopt some common classification.

The ophthalmoscope affords a better knowledge of the hypertensive states than can be obtained from any other single examination, and in most cases it makes the diagnosis and prognosis possible. Surely no internist would be without the aid of such an examination, and he does expect from the ophthalmologist a clinical interpretation of these findings.

In many hypertensive states the first ophthalmoscopic finding is that of angiospasm. This group we classify as "angiospastic hypertension." These spasms may occur in early benign hypertension, malignant hypertension, or in toxemia of pregnancy. Mylius,<sup>15</sup> Wagener,<sup>20</sup> and Halum<sup>11</sup> have described the various types of spasms seen in toxemia of pregnancy, and there can be no doubt that the spasm of the arterioles is responsible for the hypertension and that the degree of spasm is indicative of the degree of hypertension. Just what the mechanism in the development of the arteriolar spasm is remains unexplained. In spite of the experimental work of Goldblatt to the contrary, we feel that there must be some central vasomotor influence. This type of hypertension usually comes on very suddenly, and the blood pressure, as in the organic group, gives a high systolic and diastolic reading. This high diastolic pressure is an indication of the amount of peripheral resistance or, in other words, the degree of arteriolar spasm, since most observers agree that constriction of the arterioles is responsible for the hypertension. These angiospastic states have become generally recognized, and certain transitory cerebral lesions have been described by Pal<sup>17</sup> as cerebral vascular crises and by Kauffman<sup>12</sup> as angiospastic in-

sults. Pain and paresthesias of the extremities are probably angiospastic in origin, as is Raynaud's disease and erythromelalgia, as described by Westphal and Bar.<sup>24</sup> There can be no doubt that these contractures of the arterioles in the retina are angiospastic. A very striking example of such spasms not heretofore described

arteriosclerotic. Patients who develop one-sided kidney disease are likely to be in this angiospastic group, and many of the cases of malignant hypertension, if seen early, would show simply a marked angiospasm. Toxemia of pregnancy represents the most classic picture.

In angiospastic states, hemorrhages,

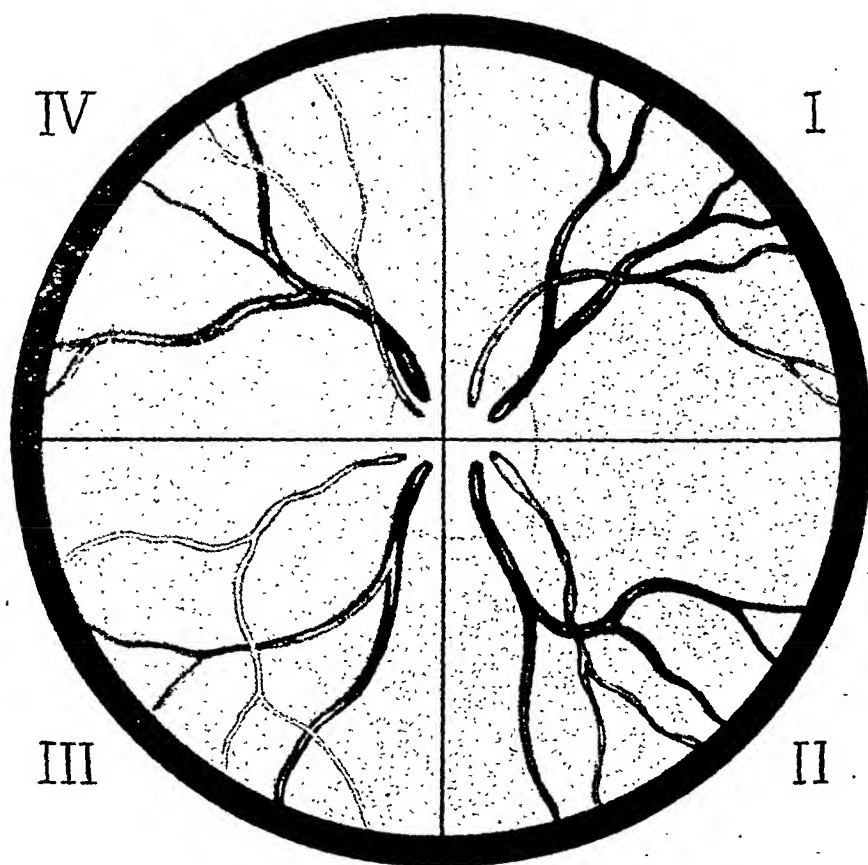


Fig. 1 (Clay and Baird). Arteriolar sclerosis.

is seen in the arterioles that supply an area of acute exudative chorioretinitis, in optic neuritis, and also, at times, in choked disc. These spasms may lead to organic changes in the vessel wall, and Wagener states that such organic changes may begin within 10 days, though we believe that a vessel may be angiospastic for months and then apparently return to normal in ophthalmoscopic appearance.

Many cases of essential hypertension begin as angiospastic states and gradually develop organic changes and so become

exudates, and edema do not occur. However, when the spasm becomes complete, edema does appear. So, in the angiospastic patients who develop exudates and hemorrhages, we believe that the latter are definite evidence of considerable kidney damage.

The spasms of the arterioles vary, depending upon the degree of hypertension, so that a grading of the degree of spasm is most important. Therefore, as an aid to clinical interpretation, we divide angiospastic spasms into four grades:

Grade I. There is only a slight irregular contraction seen in one or two arterioles.

Grade II. The contraction is found in most of the vessels and there is some irregularity in caliber.

Grade III. There is marked reduction in caliber and usually there are marked

orrhages, and exudates do not occur, as a rule, unless the spasms are in Grade III or IV. These changes are due to severe angiospastic damage in the kidney, and the patient is approaching malignant hypertension. The term to be used is "angiospastic hypertensive neuroretinopathy." The term "retinitis" should not

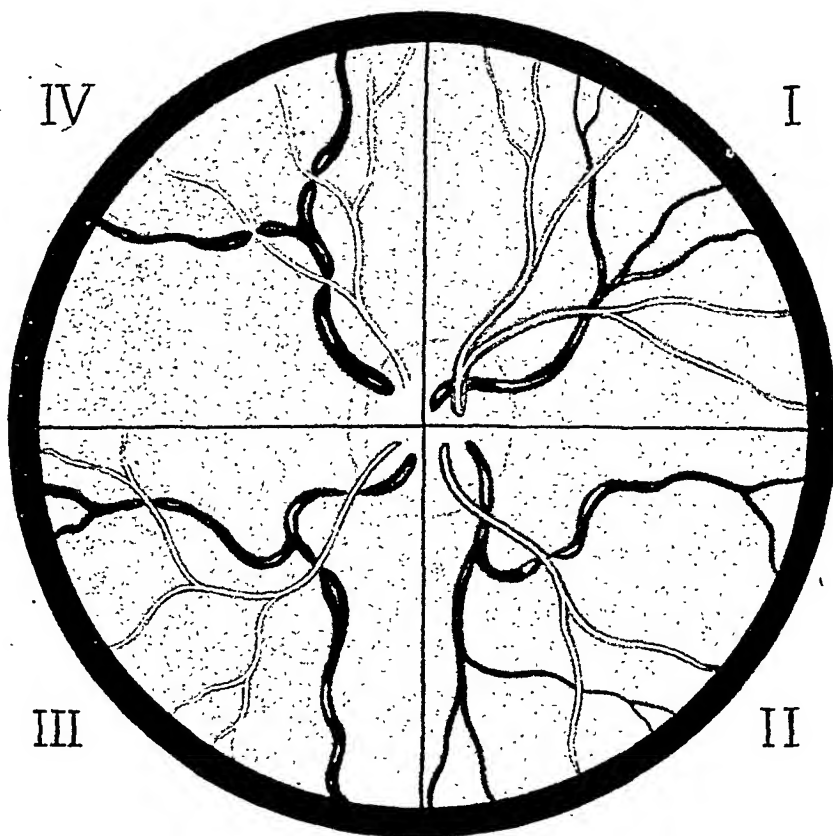


FIG. 2 (Clay and Baird). Arteriolar sclerosis.

irregularities. The higher the tension, the more irregularities there are, or the greater are the spasms.

Grade IV. The arterioles are in a state of complete spasm—mere threads, almost obliterated, as seen in complete spasms of the central artery.

If this classification is used, when one states that he has a case of angiospastic hypertension Grade II, one knows immediately the degree of involvement as well as the degree of hypertension.

In the angiospastic group, edema, hem-

be used, as the process is not inflammatory.

Spasm can easily be differentiated from sclerosis. In spasm there is little loss of transparency, the reflex stripe is not exaggerated, and there is no arterio-venous compression. It is impossible to tell when a spastic vessel begins to take on organic changes, and not until some compression of the vein is evident can one state that arteriolar sclerosis is present.

Eighty percent of all hypertensive pa-

tients should be classified as manifesting "essential benign hypertension." Following the classification of Weiss, as previously outlined, this group occurs largely under the heading of *Degenerative vascular diseases*. Of all the other groups, the one condition next in importance in the production of hypertension is glomerulonephritis. Essential hypertension may occur at any age from 8 to 80 years, but the large majority of cases occurs between the ages of 40 and 50. There is no known cause for the hypertension in this group. There is a strong hereditary tendency, however, and renal ischemia is the real factor.

This hypertensive group has in common a high systolic and usually a high diastolic pressure, the average being 160/100. However, it may read 300/180. A higher average blood pressure is usually encountered in the malignant and the angiospastic groups. The blood pressure generally fluctuates, there being some cases in which the pressure will vary from 30 to 50 mm. in a few hours. This variation is found in persons showing marked evidence of emotional instability. Patients with marked fluctuation in pressure always exhibit angiospastic changes in the fundus. The majority of these patients die of cardiac or cerebral involvement, only about 20 percent of deaths being due to renal diseases. As has been stated, the results of the examination of the kidneys is essentially negative, the urine is normal, the blood chemistry is normal, and kidney clearance tests are negative. These patients are usually free from symptoms—slight headache may be the only symptom for years. For that reason they are most frequently seen first by the ophthalmologist, who finds arteriolar angiospasm the only early positive finding. Bell and Clawson<sup>3</sup> and many others believe that spasms are responsible for the beginning of the disease: following

spasm, the vessels become sclerotic. Fishberg has shown that in practically every case the arterioles are the vessels involved; the arteries rarely show much involvement until very late in the hypertensive disease. The arteriolar disease may show fairly uniform distribution throughout the body, but the kidney will exhibit more marked disease of the arterioles.

In essential benign hypertension the arterioles are always involved, either by angiospastic or by sclerotic changes. No other fundal lesion is present except occasionally a few isolated retinal hemorrhages. These are the result of a sudden increase in blood pressure and are not accompanied by edema or exudates. We, therefore, strongly believe that the term "arteriosclerotic retinitis" should never be used. In Grade II or III of the sclerosis one may find a complete or partial central-vein thrombosis. This ophthalmoscopic picture does not indicate a bad prognosis.

The arteriolar sclerosis is the important factor in essential hypertension, and the degree of sclerosis represents the exact stage of hypertensive disease, so that it is most important to grade the sclerosis.

Arteriolar disease is seen in most cases of hypertension. The early sclerotic changes are often difficult to see with the ophthalmoscope, but as the disease progresses they become easy to recognize. We classify the vessels seen in the fundus as arterioles. Therefore, the term "arteriolar sclerosis" is used entirely. We believe that the marked reduction in caliber and the irregularities are manifestations of previous spasms, and we call this condition "arteriolar sclerosis, angiospastic type." The arteriolar disease should be divided into four stages, representing the degree of sclerosis:

Grade I. There is loss of translucency; the light reflex is increased.

Grade II. The light reflex is very distinct, and there is a slight arteriovenous compression.

Grade III. The caliber is reduced, and the reflex stripe is extremely conspicuous. There is marked arteriovenous compression, with distal dilatation. Grades II and III represent the copper-wire arterioles.

Grade IV. This is the silver-wire arteriole; the vessel has become practically obliterated and is a mere thread.

Where there is a marked silver-wire condition of the vessel, there has usually also been extreme spasm. Fishberg stated that endarteritis obliterans is most frequently seen in chronic glomerulonephritis, and Volhard and Fahr<sup>19</sup> believe that the endarteritis is the result of severe angiospasm.

To grade arteriolar disease in this way is simple and it gives the internist the type of information he needs. For example, when it is stated that the patient has an arteriolar sclerosis Grade III, angiospastic type, the internist will know at once that the patient has had a fluctuating and rapidly developing type of hypertension; that he has reached the latter stage of his disease, and probably will die of coronary disease.

Arteriolar sclerosis or angiospasm, or a combination of both, are always associated with essential benign or malignant hypertension, although a patient may have recovered from an acute hypertensive episode and his fundus fail to show any evidence of sclerosis. It is possible, on the other hand, for slight residual changes to remain in the vessels of the fundus and the patient may not present any elevation of blood pressure, but such a patient is potentially a hypertensive case.

Senile arteriolar sclerosis exists, and is not accompanied by any marked degree of hypertension. In fact, there may be only a slight elevation of the systolic pressure, and the individual will show

arteriosclerosis. The arterioles are usually reduced in caliber, but the caliber is very regular, the vessels are much straighter, and the reflex stripe is not so conspicuous as that seen in patients of the essential hypertensive group. In this senile arteriolar sclerotic group patients are much more likely to show sclerosis of the choroidal vessels. Senile arteriolar sclerosis is not just an aging process, for on ophthalmoscopic examination many persons past 70 years of age will show entirely normal arterioles.

The majority of the patients suffering from essential hypertension seen by us in the hospital develop one of two things: cardiac failure or renal disease. The group with cardiac failure will not show any lesions of the fundus other than the advancing arteriolar disease, whereas in the group with the developing kidney disease, showing a slight increase in albumin and nonprotein nitrogen, the retinas will show flame-shaped hemorrhages, a few exudates, and occasionally slight edema of the nerve head and retina. In our opinion these changes are always definite evidence of severe kidney damage, although it is true that occasionally, as was shown by Keith and Wagener,<sup>14</sup> the results of the kidney examination may be negative, and yet in almost every one of these cases before death there will be definite evidence of kidney disease. This picture is entirely different from that of malignant hypertension, and should not be confused with it by calling it the malignant phase of essential hypertension. The term that we believe is best descriptive of this group is "secondary nephritic hypertensive neuroretinopathy."

Malignant hypertension is more frequently seen in younger individuals and somewhat resembles the more severe cases of toxemia of pregnancy. These patients' blood pressure is much higher, and, usually within two to four years,

they die of a kidney disease.

Fahr,<sup>7, 8</sup> Wilson and Byrom,<sup>25</sup> and Ellis<sup>5</sup> have demonstrated that this group presents a different pathologic picture—a much more severe disease of the arterioles—which they describe as an arteriolar necrosis with greater changes in the kidney. Goldblatt's<sup>10</sup> experiments showed that such a hypertension could be produced by compression of both renal arteries, and the degree of hypertension would increase with the degree of compression. There are a few cases of essential hypertension, chronic glomerulonephritis, and angiospastic hypertension in which a malignant hypertension develops, but the majority of these cases are a distinct entity. The fundal picture of malignant hypertension is diagnostic. There is more marked edema of the nerve head and retina, and hemorrhages and exudates are more extensive. The edema is so marked that it is often difficult to see the vessels, but the arterioles show marked angiospasm with a less severe degree of sclerosis until late in the disease. The grading of this group by Wagener<sup>21</sup> and by Wagener and Keith<sup>22</sup> is best followed.

The term we believe most suited for this group is "malignant hypertensive neuroretinopathy."

The development of increased intracranial pressure in hypertension is still unexplained, but Cushing<sup>6</sup> demonstrated that the arterial pressure rose progressively only when the tension within the calvarium approached the level of the diastolic pressure. Such patients develop a choked disc, and usually this is seen in the malignant group; associated with it are all the other changes previously described.

Occasionally one encounters an interesting phenomenon in the essential benign group—a choked disc without any other findings than the severe degree of arterio-

lar sclerosis of the angiospastic type.

Nephritis will not produce changes of the fundus to any great extent, with the occasional exception of slight fluffy exudates and mild retinal edema, but when hypertension develops in such a case, more especially chronic glomerulonephritis, characteristic changes will appear. These cases do not show the severe edema of the nerve head and retina, and the exudates are more prominent, being of the waxy, glistening type. Fewer hemorrhages are present, and the arteriolar disease is not so marked. The term that best describes this group is "primary nephritic hypertensive neuroretinopathy."

The classification here outlined seems to be one that would include simply all the hypertensive states, briefly as follows:

- I. Angiospastic hypertension
  1. Arteriolar angiospasm, Grades I to IV
  2. Angiospastic hypertensive neuroretinopathy
- II. Essential benign hypertension
  1. Arteriolar sclerosis, Grades I to IV
  2. Arteriolar sclerosis, angiospastic type
  3. Secondary nephritic hypertensive neuroretinopathy
- III. Malignant hypertension
  1. Malignant hypertensive neuroretinopathy
- IV. Nephritis with hypertension
  1. Primary nephritic hypertensive neuroretinopathy

A short paper that attempts to cover the entire subject of hypertension must needs be sketchy. We hope to cover each subject classification more fully in subsequent papers.

Our studies have convinced us that the information gained from the ophthalmoscopic examination is of greater diagnostic value than that of any other examina-



tion; that frequently with this information alone an accurate diagnosis can be made; and that the classification advocated in this paper is simple and readily mastered.

There is so much confusion in the minds of the average ophthalmologist, and

there are so many different classifications, that we feel that the greatest need now is for a commission to be appointed by the three national societies to formulate proper nomenclature and classification of the hypertensive diseases.

384 Peachtree Street, N.E.

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#### DISCUSSION

DR. P. J. LEINFELDER (Iowa City): Dr. Clay's paper has been of unusual interest to me for at least two reasons, one being that he makes some statements with which I differ, and another, that he presents so much material with which I am in agreement. In the first place, there is no question about his statement that the literature with its terminology is confused. Our graduate students repeatedly come to us with the complaint that they

cannot make head or tail out of hypertensive vascular disease. As a result we have had develop our own classification which, I am happy to say, is quite a bit in agreement with Dr. Clay's outline. We can all, I am sure, take exception to parts of this outline; yet, for practical purposes, it seems to me most clearly to express the state of affairs as we see them in the study of large numbers of hypertensive patients.

There is one point I would like to speak of which Dr. Clay did not mention, but to which, I feel certain, he pays considerable attention, and that is the status of the exceedingly small arterioles, the vessels of the third and fourth branches of the central artery. We find very frequently that the first changes are seen in those small vessels and consist of local irregularities and narrowings which may progress to such an extent the small vessels are seen with extreme difficulty. In the earliest stages the changes in hypertensive vascular disease seem to be confined exclusively to these very fine vessels. As the disease advances, the vascular changes progress down the vessels toward the nerve head and in the late stages involve the largest arterioles. It is impossible for anyone to say that at the present time we know all there is to know about hypertensive vascular disease. I feel that Dr. Clay's paper contains an extreme amount of practical information which deserves careful study, and that all of us can profit from his experiences and from his classification.

DR. THEODORE L. TERRY (Boston): Dr. Clay's paper is timely and of considerable interest. My only question is whether his proposal goes far enough. The recent advances in surgery upon the sympathetic nervous system and upon discovery and removal of functioning adenomata of the adrenal glands, not only tend to control, but, in some instances, to cure the younger patient with severe hypertension. The surgeons, cardiologists, and internists most active in selecting those hypertensives who should be subjected to the surgery know of the importance of careful detailed eye examination as an adjunct to their examination and they are as concerned as we over the selection and use of proper terminology. I think they as well should be consulted before any definitive terminology is adopted by us, even

though they already are guided to a great extent by the ophthalmologist's report on the fundus findings.

DR. JONAS S. FRIEDENWALD (Baltimore): I think that Dr. Clay has brought up a very important problem in emphasizing the difficulties in nomenclature in this field. Perhaps it may help us slightly toward the solution of this nomenclature problem if we understand a little bit more fully how these confusions have developed. There are two aspects that seem to me to have contributed very seriously to the development of confusion in our study and knowledge and classification of vascular diseases. In the first place, vascular disease has been classified primarily from two points of view: the clinical point of view, and the pathologic point of view, and these two classifications have never satisfactorily coincided. The pathologist recognizes at least two primary vascular diseases: (1) the intimal disease, which consists of proliferation of the endothelium with fatty plaques in the endothelium, which are first called arteriosclerosis, and later called atherosclerosis, and have still other new names from time to time; (2) the disease recognized by the pathologist as the hyaline degeneration of the media of the artery. Since this second form occurs most often in the smallest vessels it was originally called arteriolar sclerosis, and further names have been given to it from that point of view. Both of these conditions can, on occasion, affect vessels of the same size, so that classifying the two diseases on the basis of the size of the vessel attacked, and basing the retinal classification on the fact that the arterial vessels we see in the retina are all arterioles, do not in themselves resolve the confusion. The major vessels in the retina may at some time show in some cases atheromatous changes and be associated with what used to be called athero-

sclerosis in the larger vessels. They may in other cases show hyaline degeneration and be associated in the rest of the body with arteriolar sclerosis or hyaline degeneration of the media of the vessels in other organs. Thus the overlapping of these two diseases in the medium-sized vessels constitutes one of the barriers to a reasonable classification.

The second aspect of the classification difficulty is that while either of these disease processes may be primary, each one can indirectly cause the other disease process to develop. For instance, if a patient starts out with what used to be called arteriolar sclerosis—that is, hyaline degeneration of the media of the arterioles—he can get hyaline degeneration of an arteriole in the vasa vasorum of a coronary artery. The coronary artery suffers in nutrition as a result of this hyaline change of its nutrient arteriole, an atheromatous plaque may develop on the intima of that vessel and the patient may die from a cardiac infarction. Thus atherosclerosis can in many instances occur as secondary to the hyaline change of the small arterioles. Conversely, a patient may start out with what is primary atherosclerotic disease, have an atheromatous plaque in his renal artery, and get ischemia of the kidney and secondary malignant hypertension and arteriolar changes in the small vessels. It is the fact that these two diseases are so confused in their course, and that many patients when they reach the terminal stages have both diseases, one primary and the other secondary, one mutually fortifying the other, that makes the nomenclature so confusing.

DR. JOHN N. EVANS (Brooklyn): It seems to me that our problem goes much

further back than just to classifications. We have to begin, if we are going to make progress, with a better understanding of the basis on which we draw our inferences. If we look at the retinal vessels and say, as Dr. Clay did, "vasospasm," we cannot directly justify that diagnosis from anything we have seen. What we can say is, "These vessels look narrow." Then ask ourselves, "What are the many, many things which can make vessels look narrow?" In quizzing our medical students, we may say: "What are the distinguishing appearances of choked disc and papillitis?" It is easy to make a tabulation of over 100 factors and conditions which can make the nerve head look blurry. If we cannot decide what features differentiate one of these from the other, how are we going to make progress in classifying? And so if this classification is to be accepted it will have to begin with acceptable criteria from which to draw inferences.

DR. CLAY (closing): I appreciate this discussion. I want to emphasize this point: that we consider the benign hypertensive group by far the largest group of hypertensive disease, and in these 10 cases, the chances are, that had the fundi been examined shortly before death, we would only have seen an arteriolar sclerosis, probably Grade II. The large majority of individuals whom we see with hypertension show a gradual increase in the degree of arteriolar sclerosis, and that degree of sclerosis definitely represents a grade of hypertension, in our opinion. If there are irregularities in the caliber of the arterioles we believe that it is an indication of a previous spasm, and that the individual has had a fluctuating type of hypertension.

# KERATOCONUS POSTICUS CIRCUMSCRIPTUS

## A CASE REPORT

GEORGE WISE, LT. (J.G.), (MC), U.S.N.R.

Shortly after reading Leopold's<sup>1</sup> paper, the following case of keratoconus posticus circumscriptus was encountered. Because of its rarity (only four cases,<sup>2</sup> including Leopold's, have been previously reported in the English literature), its description was felt to be warranted.

C. E. P., a white sailor, 24 years of age, was admitted to the hospital on January 11, 1944, complaining of blurred vision of the right eye. He had first become aware of the reduced vision of the right eye at the time of his naval entrance examination four months previously, this being the first eye examination of his life. Prior to that time, he had worked as a farmer and had had no eye trouble. There was no history of trauma. The past medical history was negative as was the family history, except for tuberculosis on his father's side. The patient had never been in contact with a known, active case of tuberculosis. He felt that the vision might always have been poor in this eye and that he might never have become aware of it except for the naval examination.

*Examination.* O.D., the vision was 20/50. Aside from the corneal lesion, to be described, and a small patch of medullated nerve fibers below the right disc, this eye was entirely normal.

O.S., the vision was 20/20. This eye was entirely normal except for a mild congenital ptosis, the upper lid crossing the limbus at the 2:30- and 9:30-o'clock positions.

The pupils, muscle balance, and fields of both eyes were normal. The tension of each was 20 mm. Hg (McLean).

The right globe was white. There was

no corneal staining with fluorescein, and the anterior chamber was clear. The anterior surface of each cornea had normal curvature and the cornea of the left eye was entirely negative.

Under direct illumination, the cornea of the right eye showed a large, eccentric, nebulous opacity occupying more than one-half the total corneal area (fig. 1). With the slitlamp, the posterior corneal surface in the nebulous area showed an irregularly scalloped curvature with a grayish rather than transparent appearance. The cornea, at its thinnest portion, was reduced to one-fourth its normal thickness, and this area was a little below the opacity's center. The stroma and the anterior cornea were quite normal, and there was no increase in the prominence of nerve fibers. It was readily seen that the corneal nebula was due to the changes of the posterior corneal surface. The lesion approached the limbus between the 7:30- and the 9:30-o'clock positions, but left a completely transparent zone between itself and the limbus, similar in all respects to the clear area seen in dystrophies. To be sure of this observation, the patient's head was turned to one side, and, with the light beam crossing the questionable area at right angles, the fact was demonstrated beyond any doubt.

Near the periphery, at the 8:30-o'clock position, there were a few Hassal-Henle bodies, but none was noted elsewhere. In very thin cross sections observed with the slitlamp, the edge of the lesion showed a brushlike change extending slightly into the stroma from the posterior surface (fig. 1). No corneal pigmentation was noted. Retinoscopy was unsatisfactory,

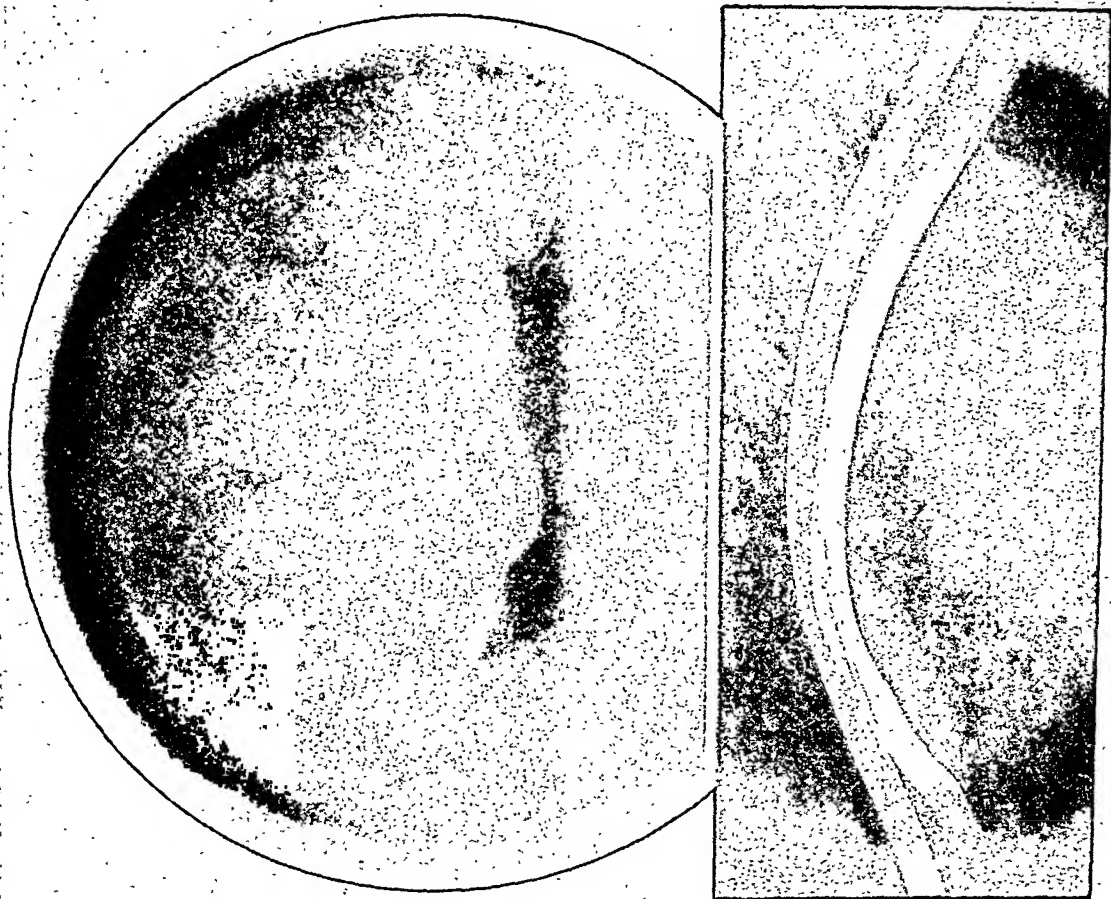


Fig. 1 (Wise). Keratoconus posticus circumscriptus.

for, with the pupil dilated, its shadow simulated that of a dislocated lens.

Vision under homatropine cycloplegia was: O.D. with a  $-0.50D.$  sph.  $\approx +2.25D.$  cyl. ax.  $150^\circ$ , 20/30; O.S. with a  $-1.00D.$  sph.  $\approx +0.75D.$  cyl. ax.  $90^\circ$ , 20/15.

The general physical examination revealed nothing of significance. Blood count, Kahn test and urine were normal.

#### COMMENT

This case appeared to be very similar to that of Dr. Leopold. Several factors seemed worth stressing: the eccentricity of the lesion, the scalloped irregularity of the posterior-surface curvature, the normal anterior cornea, and the fact that the opacity was due to changes of the poste-

rior corneal surface. Neither this case, nor any of the others described, have been shown conclusively to be acquired. A traumatic etiology has not been clearly established in any case, nor has the progressive nature of the lesion been demonstrated with certainty in any. The appearance in the case herein reported suggested neither of these.

It is interesting that a cornea can have only one-fourth its normal thickness and still withstand the intraocular pressure and maintain its normal anterior curvature. This suggests that true keratoconus is due to some abnormality of the entire corneal structure.

One other interesting feature of this case is the way in which the lesion stopped short of the limbus, leaving a clear zone

similar in all respects to that seen in corneal dystrophies.

I should like to express my appreciation to Mr. E. G. Bethke for the drawing to illustrate this case.

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## CLINICAL STUDIES IN ANGIOSPASM\*

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The question as to whether angiospasm is brought about by neurogenic factors or through chemical mediation of toxic,

humoral, or hormonal influences is today answered by most observers by the statement that both are at work either independently or together in any individual case.

In regard to localized angiospasm the possibility that in a person with an especially labile vasomotor system such phenomena can occur in a vulnerable region is not difficult to comprehend when we think of other localization phenomena such as occur in the Schwartzman reaction. On a basis of local sensitivity a small portion of a vessel can be picked out for angiospastic attack.

Although not proved it is most likely that all blood vessels are supplied by sympathetic fibers. The fibers that arise from the lateral ganglionic system are controlled by the spinal center for vasoconstriction (fig. 1). These, in turn, are under the control of the hypothalamus. A method of approach to disturbances in the region of the hypothalamus—namely, pupillography—was utilized in one of the cases of angiospasm to be reported and is recorded not for the conclusions in the findings but to call attention to this extra-aid in the armamentarium of angiospastic research.

In patients with a vasolabile apparatus in whom the difference in temperature of

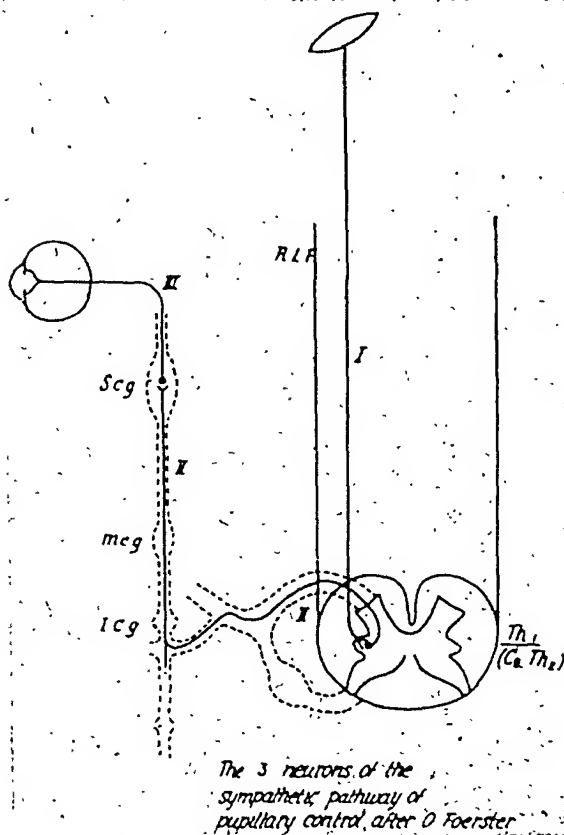


Fig. 1 (Givner). The three neurons of the sympathetic pathway of pupillary control (after O. Foerster).

\* Read before the New York Society for Clinical Ophthalmology, December 6, 1943.

the abdomen and extremities, taken in a draft-free room, exceeds 6 degrees, blocking of the tibial nerve with a 2-percent solution of procaine hydrochloride can cause a relaxation of the arterial wall together with an increase in the temperature of points distal to this block by at least 2 degrees and usually more. It does not seem unreasonable to expect some dilatation in the retinal arteries after retrobulbar injections of 2-percent novo-

13 years old she had been told that her blood pressure was 180/. At the time of this examination it was 142/100. One year ago she had had an angioneurotic edema of both lids after an emotional upset. Urinalysis revealed albumen, which disappeared after the lid condition subsided. The patient was seen during one of the attacks of flashes and blurred vision.

It should be remembered that the aver-



Fig. 2a (Givner). Fundus photograph showing the normal artery-vein (2:3) relationship.  
Fig. 2b. Fundus in case 1, showing arterial angiospasm; artery-vein relationship 1:3.

caine in cases of acute angiospastic phenomena of nervous origin if the patient is seen early enough and if endarteritic changes and organized blocking are not present. This paper presents three cases of angiospasm each of which is representative of a type.

#### TYPE 1

Evanescent retinal spasm producing visual disturbances in a patient with so-called "angioneurotic diathesis."

*Case 1.* The patient, C. S., a woman, aged 28 years, complained of flashes of light occurring for the past two years. Different parts of the visual field were affected. Since her seventeenth year the vision in the right eye had blurred momentarily and she would see only part of an object; then vision would return. Her past history revealed that when she was

age width of retinal arteries at this patient's age should be inferonasal 70, superonasal 79, superotemporal 110, and inferotemporal 116 microns (fig. 2a). Figure 2b shows the narrowing of all the arteries as compared with the normal.

At the time of an attack 10 c.c. of blood was drawn from her vein, centrifuged, and the serum injected into the tail artery of a white rat. A few words on the details may not be amiss.

A 1-percent solution of sodium amytal is given intraperitoneally, 0.8 c.c. per 100 gm. In five minutes the rat is asleep. The pupils are easily dilated with 2-percent homatropine hydrobromide. The average blood pressure in a rat of 200 gm. is about 110/80. The normal blood volume of such a rat is about 12 c.c. Normally a 5-c.c. injection, by so markedly increasing the blood volume, may raise the pressure as





Fig. 3 (Givner). Method (of Duncan, Hyman, and Chambers) for studying blood pressure in a rat.

Fig. 4. Synchronous fundus study and blood pressure readings.

high as 20 points, but no vasoconstriction of the arterioles appears either in the retina or in the small vessels of the web. The method of examination is that devised by Duncan, Hyman, and Chambers<sup>1</sup> with a special condensing lens for a light source (figs. 3 and 4). After fixing the leg, the web arterioles can be observed with 100 magnification compared to the 14 magnification seen with the ophthalmoscope. All blood flow is stopped; then it begins to come back but in a jerky fashion. This is considered the systolic pressure. When the blood flow is continuous the diastolic pressure is noted.

One cubic centimeter of the patient's serum was injected. In two minutes the pressure had begun to rise, and the retinal arteries showed a narrowing. The fundus was easily observed with the ophthalmoscope, by means of a +12.00D. lens. In eight minutes a rise of 35 mm. was noted. The control pressure showed a rise of 5 mm. It is interesting to note that the retinal arteries show the change before the blood pressure is at its highest and are relaxed before the blood pressure returns to normal.

Pupillographic studies of this patient showed the following as reported by Dr. Otto Lowenstein: "The type of reaction to light, the type of anisocoria, and the presence of a good psychosensory dilata-

tion while psychosensory restitution phenomena are poor indicate the presence of a central sympathetic lesion."

## TYPE 2

Disseminated angiospastic retinopathy—a term which I have coined for this type, having in mind Horniker's suggested central angiospastic retinitis, which was improved to central angiospastic retinopathy by Gifford and Marquardt.<sup>2</sup>

*Case 2.* The patient, F. W., a plumber, aged 52 years, was first seen in September, 1940. He stated that the vision in his left eye had become blurred in the central portion although his peripheral vision was clear. He described his vision as clouds with many colors. There has been no improvement in the condition.

Examination disclosed spasm of the temporal vessels of the left eye with edema involving the macular region. Six weeks later the right eye became affected. There was slight blurring in the lower portion of the visual field in the right eye. Examination disclosed an angiospasm of that portion of the superotemporal artery nearest the disc with edema localized to the area surrounding this spasm. The left eye showed an angiospasm of one of the branches of the superotemporal vein surrounded by localized edema. In addition, there were macular edema and degenera-

tive changes, and an accompanying central scotoma. On November 1, 1940, new areas of localized spasm and edema were noted in the right eye. In the old area the vessel was now seemingly patent and the edema disappeared. The inferotemporal artery was involved in the angiospastic and edematous process. The left eye showed the originally spastic venule opened and a new branch involved. In short, these spastic and relaxing phases covered the fundi of both eyes in a disorganized fashion. The areas where the spasm had lasted too long were left with retinal degeneration until the final picture was loss of vision in both eyes (fig. 5). The patient's blood pressure was 130/72. There was no family history of hypertension nor allergy. The patient smoked about 20 cigarettes daily. He was tested with tobacco extract 1/100 to 1/200 c.c. intradermally with saline control. The result was negative as were all other tests for allergy. Because of his occupation lead was considered a possible etiologic factor but both urine and blood were normal—urine 0.003 mg. per 24 hours, blood 0.006 mg. per 100 c.c. Blood smears showed no stippling. Blood chemistry, including cevitic acid determination, phosphatase-N.P.N., urea nitrogen, calcium, and cholesterol was normal. All foci of infec-

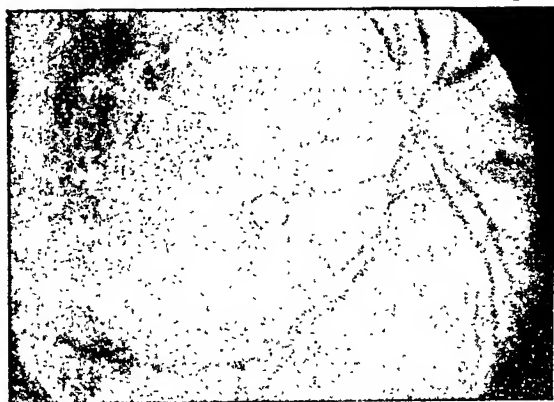


Fig. 5 (Givner). End result of retinal degeneration after diffuse angiospastic retinopathy.

tion were removed. The vascular status after a study of the nail bed was reported by Dr. A. Wilbur Duryee as normal. Venous pressure, right arm, was 58 mm.—normal; left arm 52 mm.—normal. The patient was treated with vasodilators, sodium nitrite, acetylcholine both intravenously and intraorbitally to no avail. The administration of bellergal, foreign proteins, intravenous injections of sodium chloride, and various vitamin preparations had no beneficial effect.

### TYPE 3

Angiospastic episodes of hypertensive retinopathy.

Case 3. M. B., a man, aged 53 years,



Fig. 6 (Givner). Papilledema in case 3 resembling malignant hypertension but only an angiospastic episode in hypertensive neuro-retinopathy.

Fig. 7. From the same patient 2 years later with all evidences of angiospasm gone—post-papilledemic atrophy of nerve head.

was seen on June 19, 1941, with the typical picture of malignant hypertension (fig. 6) but with normal blood chemistry. His blood pressure was 168/120. A report was sent that the prognosis as to life was bad and 6 to 12 months were given, as 79 percent die within that time. Two years later the patient came in with a complete absence of all angiospastic phenomena (fig. 7). His vision was 20/200 because of postpapilledemic atrophy, but the general status was fair. The blood pressure was 220/135. The blood chemistry was normal. The only treatment that may have had some effect was vigorous foreign protein (typhoid intravenously given by Dr. Harry Solomon). A personal communication from Dr. Henry P. Wagener noted, "I have seen several cases of the type you describe. I think there should be some way of differentiating these pictures when we see them. We are dealing with an acute angiospastic episode and not with true retinitis of malignant hypertension. So far as I can recall, the blood chemistry was normal in these cases." Such subsidence was noted as far back as 1859 by Liebreich.

It is interesting in this connection to recall the report of Smithwick and Castleman<sup>3</sup> on patients on whom they have operated (not necessarily involving cases of malignant hypertension) in eight of whom normal renal arterioles were found.

It would seem to me that just as the level of the hemoglobin helps to differentiate fundi of perplexing cases of chronic glomerular nephritis in the last stages from malignant hypertension (in that a low hemoglobin and low red blood cell content is the rule in the former and many times a high hemoglobin in the latter), so in like fashion, the blood chemistry should guide the ophthalmologist in giving a prognostic report. If the blood is normal, the condition is possibly only an angiospastic episode in hypertensive retinopathy; if abnormal, malignant hypertension may be considered to exist in view of the fundus picture.

In conclusion it is suggested that investigations on these cases in the future include if possible pupillographic studies to help gain more information as to the part the hypothalamus plays.

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## THE FREQUENCY OF SQUINT\*

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According to the literature and other available sources of information, the frequency of squint, is not a common subject. In the general population, including both children and adults, it is almost impossible to estimate it accurately, nor does it seem to be significant except from an academic standpoint. Of major importance to orthoptic technicians, however, is the incidence of different types of squint and the possibilities regarding their treatment.

The New York Society for the Prevention of Blindness has made many statistical reports on the incidence of strabismus among children in schools. In different cities in the United States the incidence of squint in children has been variously reported as being 1.5 percent, 0.8 percent, and 1.5 percent.<sup>1</sup> Children under 2 years of age, from 2 to 7 years of age, and in the preschool age showed an incidence of squint of 1.3 percent, 2.4 percent, and 4.7 percent, respectively.<sup>2</sup> The British Board of Education, London, reported that of 1,199,291 school children examined in England and Wales, 1.3 percent had squint.<sup>3</sup>

The incidence of squint in a busy clinic is next called to our attention. During the month of July the Department of Ophthalmology of the Cleveland Clinic saw 1,804 patients. Of these patients 271 were new, and 89 of them were sent to the Orthoptic Division for muscle-balance examination. Nineteen or 7 percent of the new patients had squint, which is approximately the incidence to be anticipated in new cases. During a year the

incidence may vary and may even be slightly less, since July is a vacation month when one would expect to see more muscle anomalies in children than at other times of the year.

The frequency of squint cases seen in the Orthoptic Division alone is much higher: 21 percent of the new patients had cases of squint.

It is interesting to note the relative incidence of squint in different age groups. As would be anticipated, the greatest incidence is in the younger age groups where the fusion faculty is very often faulty or not fully developed. In the Public Health Report of July 17, 1925, the number of children with squint in the United States according to age was estimated as follows:<sup>4</sup>

Age (years)	Number	Percent
Under 5	172,000	1.5
5 to 9	157,000	1.25
9 to 14	120,000	1
15 to 19	57,000	0.5

In an abstract of an article, "The incidence of squint at various ages," by T. Stewart Barrie,<sup>5</sup> the percentage of strabismus cases at different ages was estimated to be as follows:

Age (years)	Percent
5	2.01
7	2.18
10	1.79
13	1.37

Deductions made from these figures were that

1. There is a 9-percent increase in the number of cases of strabismus between the ages of 5 and 7 years.

2. There is a uniform decrease in the

\*Read before the third annual meeting of the American Association of Orthoptic Technicians, Chicago, Illinois, October 10, 1943.

cases of strabismus from 7 to 13 years.

3. From the shape of the graph, the decrease is likely to continue for some years after 13 years of age.

4. Thirty-two percent of the cases of strabismus at 5 years of age showed no obvious strabismus at 13 years.

Even in a relatively small group of squint cases examined at the Cleveland Clinic during one month, the same decrease in squint was observed as the age increased.

This definite decrease in the frequency of squint as the age increases brings up the question of what happens to the squint of these children as they become older. If untreated, does the angle of squint lessen as certain anatomic features of the head and eye mature, such as a decrease in the amount of hypermetropia? Do some children develop fusion much more slowly than do others, or are so many children being treated for squint that the incidence decreases as the age increases? Children do not just "out-grow" squint, and early treatment will give the best results in developing single binocular vision.

Dr. Frank N. Knapp,<sup>6</sup> in an article entitled "The economic importance of squint in children and its effect in after years," made a survey in April and May of 1929 in a mining company; 4,424 men were examined. He found that 4.3 percent of men suffered from squint out of a total of 339 men referred for examination and refraction. Of these, 2.6 percent had divergent squint and 1.7 convergent. Ten percent of those examined had amblyopia ex anopsia. Since 4.3 percent had squint and 10 percent had amblyopia ex anopsia, apparently many of the men with low vision in one eye had straight eyes. If the eyes of any of these men had been straightened by surgical means, or remained straight because of normal balance in a fusion-free position, there

evidently had been no orthoptic treatment to develop binocular vision, and the patient kept suppressing the amblyopic eye the rest of his life. This percentage of men with amblyopia ex anopsia shows a great economic loss and emphasizes the importance of orthoptic treatment at an early age.

In the foregoing survey it will be noted that the cases of divergent squint were much more common than the cases of convergent squint. This, of course, was in an adult group. The higher frequency of exophoria and convergence insufficiency, which we have noted at the Clinic and which is so common in adult cases, inadvertently strengthens the theory that divergence of the eyes in a position of rest is more the rule than so-called balance or orthophoria; and when blindness occurs in one eye, a latent divergence becomes manifest.

In Dr. Knapp's survey of public schools in Duluth, 288, or 2.35 percent of a group of 12,253 children, had squint.<sup>6</sup> Of these, 217 were found to have convergent squint. In another Public Health Report, by Selwyn D. Collins,<sup>4</sup> the percentage of strabismus in a group of 12,134 school children was 0.91. Of these 0.73 had internal strabismus as contrasted with only 0.17 percent with external strabismus.

Most writers are agreed that concomitant convergent squint occurs most frequently in children. Dr. Bielschowsky,<sup>7</sup> in his "Theory of heterophoria," states that in children up to 15 years of age a convergent strabismus develops after the loss of binocular vision five times as frequently as in persons of 30 years or older. According to Dr. Allen<sup>8</sup> of Iowa City, the presence of convergent strabismus in children may be explained by the fact that most children are hyperopic.

Of the 166 cases seen at the Cleveland Clinic which were analyzed for this re-

port, 115 cases, or 69 percent, were of convergent squint: 36 cases, or 22 percent, of divergent squint, and 15 cases, or 9 percent, of vertical squint. Of course, many of the cases of convergent and divergent squint were associated with hypertropia. The cases were classified according to the greatest amount of deviation.

The various kinds of squint were classified as monocular, alternating, accommodative, and paralytic. Monocular squint was most common both in the convergent and divergent cases, the convergent monocular being 67 percent and the divergent monocular being 69.5 percent. Next in frequency were the cases of alternating squint, 26 percent of which were convergent, and 19.5 percent divergent. Of the convergent series 4.4 percent were accommodative (third in frequency of convergent squints). Of the paralytic squints, 11 percent were cases of divergent squint and only 2.6 percent of convergent squint. There was a higher percentage of both abnormal retinal correspondence and amblyopia ex anopsia in patients with convergent squint as compared with those with divergent squint.

Some interesting points relative to the age incidence were that:

1. Of the 115 cases of convergent squint which were analyzed, the onset in all but 2 cases occurred between birth and 7 years of age, the majority occurring at preschool age.

2. In 36 cases of divergent squint 8, or 22 percent, developed after 7 years of age.

This reveals that 1.7 percent of the cases of convergent squint developed after the age of 7 years as compared with 22 percent of the cases of divergent squint. The fact that 52, or nearly half, of the patients with a convergent squint which developed in childhood were adults at

the time of examination indicates that the squint tends to persist in later years unless treatment is begun at an early age.

There is not a significant difference in the incidence of deviations of the right eye and left eye. Of the cases of convergent squint 41 had a right-eye deviation and 45 a left-eye deviation, and of the cases of divergent squint, 18 had a right-eye deviation and 10 a left-eye deviation. In a group of 62 hypertropias and hyperphorias, 23 had a right hyperphoria or tropia, 30 had a left hyperphoria or tropia, and 9 were bilateral. This does not seem to be of significance, although in a larger number of cases, there may be a greater difference.

Almost all of the patients with squint wore glasses. Only a few had anisometropia. In the cases of convergent squint only 7 percent were myopic, the rest being hyperopic. Thirty-one percent of the patients who had divergent squint were myopic, 69 percent being hyperopic. In July, 1925, Selwyn D. Collins<sup>4</sup> reported the incidence of strabismus and difference in visual acuity in the two eyes. He found that the incidence of squint increased as the visual acuity decreased in equal vision. In unequal visual acuity the greater the difference in the two eyes, the higher the incidence of strabismus. The incidence of strabismus in these cases of unequal visual acuity increased more than in those with equal visual acuity. Where vision was 20/30 or better in one eye and 20/70 or worse in the other, the incidence of strabismus was increased as much as 10.45 percent as compared with 2.52 percent in equal visual acuity of 20/70 or worse.

Another type of squint is caused by blindness or partial blindness of the eye from various causes, such as corneal opacities, traumatic or congenital cataract, lesions of the retina or choroid, and so forth. When the eye becomes blind and

the patient no longer has fusion to hold the eyes parallel, the eye deviates out or in, or remains straight according to the position of rest, or the fusion-free position. In children the eye usually turns in, and in adults it usually turns out. These pathologic cases are sent to the Orthoptic Division for examination only if the patient wishes to have the eyes straightened for the cosmetic effect.

The frequency of squint may be summarized as follows:

1. In children the incidence is usually between 1 and 2 percent.

2. Squint is more frequent in younger children than in older children or adults.

3. In school children convergent squint has a higher incidence. In adults divergent squint has a higher incidence.

4. The frequency of squint according to type is as follows:

- a. In convergent squint.

- (1) monocular

- (2) alternating

- (3) accommodative

- (4) paralytic

- b. In divergent squint

- (1) monocular

- (2) alternating

### (3) paralytic

Paralytic squint is more frequent in divergent than in convergent squint.

5. There is a higher percentage of abnormal retinal correspondence and amblyopia ex anopsia in convergent than in divergent squint.

6. According to the time of onset of squint 1.7 percent of the cases of convergent squint develop after 7 years of age as compared with 22 percent of the cases of divergent squint.

7. There is no significant difference in the deviating eye in convergent, divergent, or vertical cases.

8. The refractive error is hyperopic in most cases, although there are more patients with myopia in the cases of divergent squint than in those of convergent squint.

9. The incidence of strabismus increases as the difference in visual acuity becomes greater between the two eyes. Strabismus also increases as the visual acuity in both eyes decreases, but not so markedly.

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## ESSENTIAL REQUIREMENTS FOR A GOOD ORTHOPTIC DEPARTMENT\*

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In establishing an orthoptic department, first at the Milwaukee Children's Hospital, and later in expanding and developing the private patient's clinic at the Milwaukee Ophthalmic Institute, it was the intention of the Milwaukee ophthalmologists concerned to do all in their power not only to make an effort to bring about cosmetically straight eyes in the strabismic patient, but, in addition, to supply the means whereby the brain could be reeducated to permit the eyes to function as one complete and single unit in daily life.

Orthoptic training is definitely not a cure-all for the strabismic patient and should not be looked upon as a last resort by the ophthalmologist. We do not consider it a substitute for any other form of treatment but rather as an adjunct to these. Granted that in some instances the patient may dispose of his previously prescribed glasses or may avoid surgery, it is nevertheless, as stated previously, the principal purpose to teach or reeducate the brain to permit the two eyes to function as one single unit by use of the various means available. During this process, which may take from 6 months to 12 or 18 months or even longer, orthophoria may also develop.

When first establishing the orthoptic clinic at the Milwaukee Children's Hospital on a full time basis, we requested a sufficient amount of space to permit of a quiet and undisturbed workroom. This allowed the patient and technician to become acquainted in a gradual and unhurried manner, the attention of the

patient being unimpeded by outside disturbances. There are arguments both for and against having more than one technician and patient working in the same room simultaneously. We have found that our results at the Institute where we deal with several private patients in the same room at one time compare favorably with those at the Clinic where only one technician is present at a time. Sufficient space must, however, be allowed so that a certain amount of privacy can be maintained. Screens, simulating booths, between the instruments help to give this impression of privacy. A certain amount of beneficial competition can also be stimulated where more than one patient is present for treatment during each appointment. Frequently the shy and timid child gains considerable confidence from seeing another child present, as it is our habit not to have the parents in the room with the patient during the treatment period. Time is allowed for the parents before and after the treatment for questions, and the like.

In establishing a unit of this type it must of necessity be controlled by ophthalmologists who are in sympathy with orthoptic training and who understand the fundamentals involved in this work. The technician works under the supervision of the ophthalmologist and must be able to carry out his instructions intelligently.

Inasmuch as the technician who has been certified by the American Orthoptic Council has subscribed to a code of ethics which prohibits her from carrying out any treatment not ordered by the attending ophthalmologist, close co-operation and consultation on the part

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of both physician and technician are required in order that the maximum of value may be obtained. As can readily be seen from the foregoing, it is imperative that the ophthalmologist be familiar with such phases of the work as the accepted and approved treatment for an abnormal retinal correspondence. It would prove rather embarrassing, for example, if home training on a Holmes stereoscope were ordered in this type of case.

The association between ophthalmologist and technician is a close one and one in which mutual confidence must be felt. Because the ophthalmologist customarily leaves the mechanical phases of the procedures to be followed to the discretion of the technician, it is imperative that she be well trained. She must be capable of holding the interest of her charges, most of whom are children. She should have a basic understanding of educational psychology and child management. She must also have an unlimited amount of patience as well as intelligence, a keen imagination, and a sense of humor.

She must have an intense interest in and respect for children as personalities and should derive real pleasure from their association. Above all, unless the patient and parents (provided that the patient is a child) have complete confidence in her ability, the technician will find her usefulness greatly curtailed and the best results will not be achieved.

It is the technician's responsibility to familiarize herself with the various types of equipment that are available and most beneficial in each individual case and to apply from her training the various types of treatment indicated. The routine work which after a period of months becomes rather tedious and boring to the patient must be glamorized as much as possible by the trained technician.

Assuming that the technician is a properly qualified individual a careful selection of patients must be made on the bases of type of squint and personality. Patients having a paralytic strabismus of obvious organic pathology, or Duane's syndrome, are not accepted for treatment. If more than one technician is available the patient is assigned to the one most likely to obtain and maintain coöperation. We make it a policy, however, to rotate the patients to a certain extent, for such rotation helps create new interest and stimulus for both technician and patient. We find it more satisfactory also for our periodic discussions, if this is done relative to the type of work to be carried on, or the advisability of continuing with orthoptics.

The parents of children under treatment must accept certain responsibilities. In our original conference with the parent we discuss the patient's disposition, traits, and general characteristics, and lay out a tentative course of treatment. It is explained that functional training is an educational process just as is learning to play the piano and that time must be allowed as in orthopedic work and in orthodontia. It requires just as much attention, coöperation, and practice. Responsibility for much of this must rest upon the parent. Patients are seen by appointment, for which a definite period is reserved either twice or three times a week for an approximately 30- to 40-minute working period. Parents who show a negligent attitude toward keeping their appointments regularly or promptly are quickly called to task. Shortening of the allotted working period will usually bring the desired results as even though the charges are reasonable the fact that the period of training covers so many months makes it an economic factor of importance in most homes in our locality.

When a patient fails to make satisfac-

tory progress a private conference is held with the parent. The child is also given the responsibility of coöperating in a more satisfactory manner. In the Clinic at the Children's Hospital, we are occasionally able to call on the social-service department to make a home call, although usually, when this is necessary, the parents are neither mentally nor emotionally able or willing to accept responsibility. Frequently by contacting the school, either directly or through the parent, more can be accomplished toward better coöperation, for the lack of proper understanding in the school of what is being aimed at is an important factor in the patients' poor response to treatment.

The terms "transferred" and "referred" have been discussed as to which is the more applicable when used for the procedure we follow.

In the Milwaukee Children's Hospital clinic the strabismic patient is sent or referred to the eye department. Here a preliminary diagnosis is made, a retinoscopy is performed, and glasses, if necessary, are ordered. The patient is then referred or transferred to the orthoptic clinic.

After a series of diagnostic orthoptic tests have been made by the certified technician, the ophthalmologist in charge of the orthoptic clinic decides whether or not orthoptic training will be of any value or if an attempt should be made merely as an experiment. This can be done more easily as an experiment in a clinic than with private patients. Following the conference of the ophthalmologist and the technicians, the question of occlusion and a course of training are decided upon. Patients in the orthoptic clinic at the Hospital return periodically to the doctor in charge of the orthoptic clinic or as often as he wishes to see them. After the orthoptic department has decided that surgical intervention should be considered he is "transferred" or "referred" back to the original re-

ferring ophthalmologist, who either performs the surgery himself or else arranges to have it performed by another ophthalmologist, usually the one in charge of the orthoptic clinic. In other words, the orthoptic clinic controls the length of time that uninterrupted treatment is to be carried on, but the original ophthalmologist performs the surgery if he so desires. In this manner the orthoptic department cannot be exposed to the charge of "stealing surgery." All other phases of the work as occlusion, reducing the strength of the lenses, or removing the glasses entirely, are under the control of the orthoptic department.

A similar procedure is followed at the Institute. Patients are referred or sent to us by the ophthalmologists on our staff and provided space is available also by any ophthalmologists in good standing with the Milwaukee County Medical Society. Written permission for occlusion and other treatment is sent to us, and a form filled out containing all the necessary data regarding the fundi, refraction, and type of squint. As stated previously, we do not accept certain types of cases such as paralytic, and others. The first visit is considered more of an introductory visit than a treatment, thus permitting the child to adjust himself to us and accept us as friends. As stated previously, patients are seen two or three times a week by appointment. It is our custom to carry out a series of diagnostic tests covering five or six visits to the Institute. Following this, a complete report is sent to the ophthalmologist, who then discusses the various factors involved with the parent or patient, depending on the age. Provided that the patient returns for active orthoptic training he is then given intensive supervised training at the Institute and when possible some additional home work is also given. We feel very definitely that only the exceptional individuals may work

at any instrument without constant supervision. Even in the adult, eyes and attention will wander when the patient is not supervised. Our patients at the Institute return to their ophthalmologist periodically every two or three months, as may be desired. The attending ophthalmologist regularly confers with the technicians in regard to reducing the strength of the lenses or when surgery is indicated.

We have accepted patients both at the Institute and at the Clinic for orthoptic training where for economic reasons or others equally good it was not deemed feasible to try to continue with training until single binocular vision could be established. Rather orthoptic training was continued only until such a time as equal vision and a normal retinal correspondence with some fusion amplitude was developed before cosmetic surgery was performed. This policy may not be approved in all areas but it does solve the problem for the patient with barely average finances.

Because of the length of time involved until the course of treatment is brought to a close it is important that fees be kept at a minimum. They must, nevertheless, be sufficient to maintain the clinic or office on a self-supporting and paying basis. In order to eliminate any "dead" accounts from among our active patients we have followed the policy of requesting that payments be made in advance, either on a monthly or semimonthly basis. As a result, our financial losses to date have been negligible. A standard fee is set for a diagnostic series and for a monthly series with two visits per week, and also with three visits per week. Single visits which are used for periodic return visits only also have a set fee. No money may be refunded, no rebates are granted, and no professional courtesy is extended. The patient is instructed in all these points before beginning treatment. We therefore

feel that even though the technicians must discuss the question of payments with the patient as well as notify him when each new series begins, the situation is less annoying or embarrassing than would otherwise be the case. The ophthalmologists sponsoring the Institute have been instructed to refer only those patients to the Institute who are able to carry the additional expense of these treatments. The Children's Hospital Clinic assumes the care of the majority of those unable to attend the private clinic.

As stated previously, quiet and privacy are necessary requisites in choosing a workroom. A separate room must be supplied as a reception room to eliminate all possible disturbances. If possible, the working space should be 20 feet in length, to permit carrying out examinations and treatments requiring optical infinity.

Certain equipment must be considered as essential whereas other types may be classed as accessory or supplementary equipment only and therefore not an absolute necessity.

The following equipment is necessary for the diagnosing of a muscle imbalance and type of strabismus satisfactorily and completely:

1. Muscle light at 20 feet and 33 cm. Accommodation chart at 20 feet and 33 cm. for determining an increase in the angle of deviation when accommodating (33 cm. is the distance used in our two clinics for all near measurements).

2. Paddle for alternate or single cover test.

3. Set of loose prisms varying in strength up to 50 p.d. (It is advisable to avoid the very small square prisms, for they are more difficult to hold. The plastic sets avoid the constant danger of breakage but have the disadvantage of scratching easily. A rotary prism, or prism rack is also desirable but not a necessity.)

4. Some method for determining the

type of fusion present in daily life or lack of fusion, such as the Worth Dot Fusion Test for both 20 feet and 33 cm.

5. A visual acuity chart as well as an illiterate chart.

6. Some means for testing for amplitude of accommodation and near point of convergence.

7. Adequate records for keeping data on each patient on all visits. In addition to these items some ophthalmologists prefer the Priestley-Smith tape or the perimeter, although we have found the cover test with prisms the most satisfactory method for measuring the angle of deviation.

8. A major amblyoscope, such as the synoptophore, synoptoscope, and orthoptoscope, is an absolute necessity for diagnosing, reeducating the brain, and developing good fusion ability, especially when an abnormal retinal correspondence exists. The first two instruments mentioned are of English design and at this time almost impossible to obtain. All three of these meet the approval of the American Orthoptic Council.

The Wottring Troposcope, which may soon be available as a major amblyoscope, is being planned to meet the approval of the Council as such.

Among the supplementary instruments which meet the Council's approval are the stereo-orthopter and the rotoscope. These cannot be used in all types of cases as can the major amblyoscopes.

Among the more simple pieces of supplementary equipment, a few of which are advisable for variety and interest for the patient, we have the diploscope, the Remy separator, the cheiroscope, the Correct-Eye-scope, and the bar-reader.

The hand diploscope and Remy separator can be made by anyone who can use a ruler and a few tools. Both help the patient in his transition into daily life and stimulates single binocular vision. The cheiroscope and Correct-Eye-scope are intended to teach brain, hand, and eye coördination. The metronoscope with a phorometer is also a supplementary instrument used especially for certain phases of fusion training. The Tel-Eye-Trainer has a mechanical attachment which automatically can control the type of flashing desired. It also is a glorified stereoscope. The Howard-Dohlman apparatus is still an accepted means for measuring depth perception.

The establishing and developing of an orthoptic department is a satisfying accomplishment for both the ophthalmologist and the orthoptic technician. We do not expect to "cure" the strabismic patient, but we hope by one means or another to give him single binocular vision and orthophoria if possible. This is a goal we do not always succeed in reaching but much satisfaction is felt when we do succeed.

*Milwaukee Ophthalmic Institute.*

*Milwaukee Children's Hospital Clinic.*

## DISCUSSION

DR. F. BRUCE FRALICK (Ann Arbor): One of the first essentials in establishing an orthoptic clinic is the local ophthalmologist's honest desire for help from the orthoptic technician. It must be admitted that few ophthalmologists possess full understanding of the subject or the temperament required to carry out these exercises

efficiently. This lack of understanding creates a strong feeling of skepticism, places the technician on the defensive, and thus hampers the fullest coöperation between the technician and the oculist.

Secondly, a successful orthoptic clinic can be maintained only by a well-trained technician who has the personality not

only to develop the fullest coöperation of the patients but that of the parents. No amount of basic training will compensate for lack of personality. The best indication of technical ability is a Certificate from the American Orthoptic Council, but recommendations of the technician's sponsors and one's own impression of her personality are most important.

The technician's duties should not include those of the office nurse unless she is permitted so to arrange the time as to

give her undivided attention to the patients receiving orthoptic training. Without this arrangement, frequent interruption in her work would result and most likely make it impossible for her to regain the child's interest in the work for the day.

Those contemplating developing an orthoptic clinic would do well to follow the suggestions outlined in the discussion by Miss Dicke.

*University Hospital.*

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## PRECAUTIONS NECESSARY IN ORTHOPTIC TRAINING\*

LAURA B. DRYE, R.N.

*Pittsburgh, Pennsylvania*

In discussing the technical application of orthoptics too strong an emphasis cannot be placed on the necessity for observing certain essential precautions.

If, in setting up her routine, the orthoptic technician will establish a procedure of checks and balances, possible errors can be reduced to a minimum and the benefits derived will help the patient as well as the technician. At the initial examination, a careful study of the patient's eyes for motility constitutes a primary procedure. Vision with and without glasses should be recorded, and measurements made with prisms and cover-test at six meters and 25 cm. with and without glasses. With full correction and the addition of a +3.00D. sph., the patient is measured at 25 cm. to determine his accommodative factor. A check should be made with red and green glasses to define the type of diplopia present. Worth's Four Dot test is then employed to ascertain if binocular vision exists.

The next step is the Bielschowsky test

for the evaluation of the afterimage. The patient's subjective and objective angle is then measured on the synoptophore, and the presence or absence of fusion and depth perception determined. Upon completion of this orthoptic survey, the technician knows the ocular imbalance and the status of binocular vision, and can therefore proceed to treat her patient with a maximum of intelligence in a minimum of time without wasting effort on skills within the patient's scope.

Upon reaching this point, the range of the patient's performance orthoptically being understood, it is extremely important to discuss the case (if the patient is young) with the parents and to infuse both parents and child with a thorough understanding of the coöperation expected during the course of treatment. Lacking this understanding and at least a modicum of enthusiasm, little can be accomplished, and orthoptic treatment, even in the mildest cases, will be ineffective. Since the patient's emotions are involved, there are times when, to secure proper response, a degree of ingenuity and a knowledge of child psychology are as invaluable to the

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\* Read before the fourth annual meeting of the American Association of Orthoptic Technicians, Chicago, Illinois, October 11, 1943.

technician as her instruments. Another precaution well worth observing is that of treating young patients early in the day before fatigue complicates matters by reducing attentiveness. During all stages of orthoptic treatment, it is essential that the patient be encouraged to concentrate and to accomplish the utmost within the compass of his mental equipment.

If the examination shows the presence of amblyopia ex anopsia, occlusion is necessary. Occlusion may range from a total type to a light application of lacquer. Total occlusion is imperative if the amblyopia ex anopsia is of a marked degree. The precaution of seeing that the occlusion recommended by the technician is properly carried out is important. However, it has been definitely proved that occlusion in itself will not restore impaired vision. Organized and supervised homework for exercise at 6 meters as well as for near is efficacious; if reviewed and checked at intervals by the technician, it proves well worth the effort expended.

If anomalous retinal correspondence is present, total and constant occlusion becomes of vital importance. Homework is not recommended in such cases, inasmuch as it tends to stimulate the abnormal retinal correspondence. The Bielschowsky afterimage test and the major amblyoscope have been found indispensable for checking and treating patients in this category. Particularly during this stage of treatment must the technician give unstintingly of her enthusiasm and resort to her highest skills to sustain the confidence and coöperation of her patient. A thorough understanding of what the technician aims to accomplish reduces the patient's apprehension and helps to obtain his fullest coöperation. After normal retinal correspondence has been established, the patient's condition may be treated as an ordinary fusion case. If the angle of deviation remains the same after fusion

has been established and an attempt has been made to develop amplitude, an operation is indicated.

In the treatment of suppression, prevalent in a high percentage of cases, occlusion is employed, its extent being commensurate with the degree of suppression. Again, it is a wise precaution to instruct the parents and child in the reasons for, and the proper use of, this medium. The better their understanding of the technician's goal, the more satisfactory the results. Enforcing the correct usage of occluders presents one of the technician's most difficult problems, hence extreme precaution must be taken to insure the patient's continuous, sincere coöperation in following the prescribed routine.

In uncomplicated accommodative squint, cures have been effected in from two to eight months, depending upon the intelligence, coöperation, and concentrating ability of the patient. Children of school age can be readily taught to dissociate accommodation and convergence. In treating fusion cases in which no suppression or abnormal retinal correspondence is involved, unless improvement is noted within a reasonable period of time, the patient should be referred back to the ophthalmologist.

It has been our good fortune that most operative cases treated prior to surgery have been returned to us by the ophthalmologist for postoperative treatment or checkup. The precaution of checking the patient at intervals after proper muscle balance has been established might be stressed at this point. In a large percentage of our cured strabismic cases, the ophthalmologist recommends a yearly examination. Recently, it has been our privilege to check several patients, who, after a cure of six years' standing, showed no deviation whatever and enjoyed comfortable binocular vision. What greater en-



couragement could a technician desire?

In concluding, I wish to mention that the precautions necessary in orthoptic treatments are so multiple and of such manifold character that only the highlights, the most important precautions have been discussed in this paper; namely,

1. Examining the patient for deviation and binocular capacity.

2. Imbuing parents and child, where occlusion is used, with a thorough understanding of its purpose, and the role they

must assume, under the technician's regular supervision.

3. In anomalous retinal correspondence, no homework should be given.

4. If no improvement is observed after reasonable treatment, the patient should be referred back to the ophthalmologist.

5. Patients should be encouraged to see their ophthalmologist for a yearly check after cure or establishment of normal muscle balance.

*Eye and Ear Hospital.*

## NOTES, CASES, INSTRUMENTS

### A METHOD FOR THE PROJECTION OF EYE SPECIMENS\*

T. E. SANDERS, M.D.

*Saint Louis 3*

A simple and convenient method for the projection and demonstration of sectioned pathologic material is desirable not only in presenting case reports, but also in the routine teaching of pathology. In most specimens in general pathology a relatively high magnification is necessary to give some histologic detail. In the study of ocular pathology the majority of the important facts can be demonstrated with a relatively low power. In fact, the relationship of intraocular pathology can often best be shown with lower magnifications than are available in the usual microprojectors. The usual apparatus available is a modification of the ordinary microscope with a powerful source of illumination, usually a carbon-arc. These instruments are expensive, complicated to operate, and relatively stationary. The following method for the projection of eye specimens has proved to be simple, cheap, and always available.

A celloidin section of a globe that has been cut in the ordinary manner is stained, usually with hematoxylin and eosin. Instead of mounting on a microscope slide with cover slip, the stained section is mounted in gum dammar on a 2 by 2-inch lantern slide. A similar slide is used as a cover slip and the edges carefully approximated. The excess gum dammar is expressed and the slide allowed to dry for several days. The edges are then bound with lantern-slide tape. Personally, I have never mounted a paraffin section in this way, but I can see no reason why this type of slide could not be substituted for the ordinary microscope slides. This slide can then be projected on any of the small 2 by 2-inch projectors, such as are used for kodachrome transparencies. In the ordinary room the image of the eye on the screen is about three to four feet in diameter. Such gross lesions as tumors are best shown. If it is desired to show any histologic detail, this can easily be done with the same projector, using 2 by 2-inch photomicrographs.

This method seems quite obvious, but I am reporting it because I have never seen it described, and it has proved interesting to a large number of ophthal-

\*From the Department of Ophthalmology, Washington University, and the Oscar Johnson Institute, Saint Louis 10.

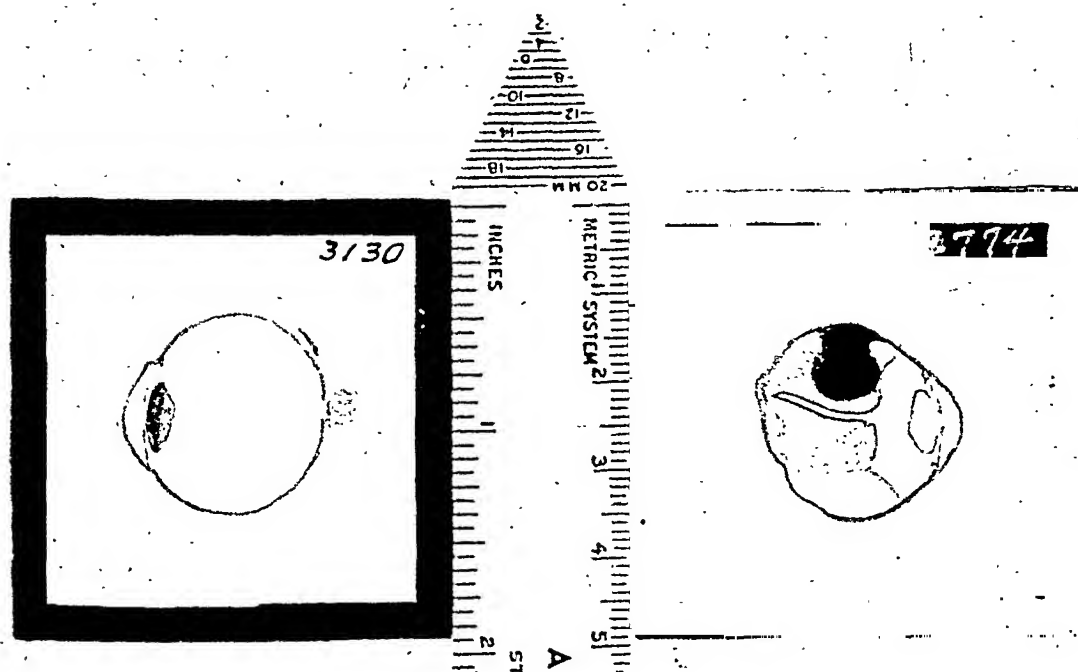


Fig. 1 (Sanders). Projector slides prepared in the described manner, showing a globe with glaucoma and one with tumor.

mologists, none of whom had seen it previously.

508 North Grand Boulevard.

### THE TREATMENT OF TRICHIASIS WITH CHOLINE\*

THEODORE J. DIMITRY, M.D., AND  
IGNACIO MIJARES, M.D.  
New Orleans

As regards trichiasis, clinicians are agreed upon the definition that it is an affection of the cilium and primarily its follicle. As a consequence of the disease of the hair follicle, the cilium is poorly nourished and turns inward in a lifeless manner to impinge upon the cornea.

Although trichiasis pathology is recognized as an eyelash-follicle disease, such

knowledge is not put to use in its treatment, for when epilation and electrolysis alone are adopted, no consideration is given to the disease in the follicle. The effects of these two means are of but short duration, for the lashes continue to develop from the site of the follicle supposedly destroyed by electrolysis.

At the University of Salerno, in the tenth century, a different approach to this problem was approved. Bile was instilled into the eye to cure the disease in the follicle. Though the use of bile is legendary, according to the historians of today, we propose to show that choline, a constituent of bile, is a most remarkable agent for the treatment of trichiasis.

There occurs at times an aberration in lid development in which the tarsus is absent or undeveloped and the lashes unsupported, are left to strike the cornea; but this is not trichiasis in that the follicle

\* From the Department of Ophthalmology, Louisiana State Charity Hospital.

is normal. It is a recognized fact that a cilium may contact the cornea without either the cilium or the cornea being diseased. Entropion, for instance, will produce such a condition.

It is important to recognize that in pathology of trichiasis, it is the follicle that is diseased and it is the follicle to which treatment should be directed. We are not concerned with the destruction of the follicle but with restoring it to health. We aim to remove from the follicle factors that interfere with the growth of a normal cilium.

Probably the most common factor in the beginning of follicular disease is a blepharitis marginalis. Trachoma, pemphigus, and deficiency diseases that cause a blepharitis bring about pathologic change in the follicle. No matter what the cause, choline is beneficial when the follicle is filled with lipoids and cholesterol.

The cilium has its root some two to three millimeters within the follicle and is nourished by the glands and vessels about the follicle. Its curve depends upon the base of the root and the exposed length as, also, upon its shape and diameter. Near the lid border the cilium is cylindrical. Farther out from the lid margin the cylinder flattens and becomes narrowed and, because it lacks equal support throughout its entire extent, it curves. In trichiasis there is no longer the normal curve; the cilium falls as though from a physical inertness.

Choline, which we have found so beneficial, has been fully described in biochemical, physicochemical, and physiologic treatises. It has been well established as a lipotropic agent of great merit. It is because of the lipotropic power that we adopted it in the treatment of trichiasis.

The pH of choline in aqueous solution, 5 grains to the ounce, is nearly

perfect for the external ocular tissues (7.1). It is so little irritating that the conjunctival cul-de-sac may be flooded with it almost continually, if necessary. *It has been used by us to lave the anterior chamber of the eye.* Choline has moderate antiseptic qualities and, having both a polar and a nonpolar molecule, can, because of this chemical formation, penetrate deeply into tissues and carry with it other agents, if necessary. It is soluble in oil and in water and possesses a definite predilection for lipoids and cholesterol; so much so that in the reversal of the lipoids, phospholipids are formed which are readily transported away from a pathologic condition that previously existed, and which they may have helped to maintain.

Choline rids the follicle of these two designated chemicals; namely, lipoids and cholesterol. Besides possessing all of these unusual qualities, *it seeks out diseased channels to travel in and through in order to reach a pathologic condition.*

In trichiasis choline is employed locally either in water or in an oil solution and may be used in crystal form directly applied to the lesion in need of treatment. In water and in oil it is used in a strength of 5 grains to the ounce. In whatever manner it is used, it penetrates into the follicle. It may even be used orally to affect the trichiasis, but the treatment is extended.

We have not and do not expect to observe any harmful effects from its use in the treatment of trichiasis, and our experience has been great.

The time required for effective action in trichiasis is but a week or thereabouts. It is to be borne in mind that choline is also a detergent, and because of this quality can be used in the removal of scabs from the face and lid margins.

Twenty cases of trichiasis have been treated with a solution of choline. Two

of the patients also had pemphigus and one had trachoma. Choline had a remarkable effect in each case. In the case of pemphigus choline was used as an eye wash; in the case of trachoma, crystals of choline were applied to the lids.

*In conclusion:* The lipotropic agent choline is most remarkable in its effect upon trichiasis. The simple trichiasis was selected from a series of pathologic changes to demonstrate the basic potency of choline. It chemically removes lipoids and cholesterol from diseased follicles without altering the normal follicle. It appears to restore the follicle to health. New lashes may be formed normally where the diseased lash previously existed and it accomplishes such action without harming tissues.

#### A CASE OF INTRALENTICULAR FOREIGN BODY WITH EARLY REMOVAL\*

BERNARD KRONENBERG, M.D.  
*New York 19*

A case of intralenticular foreign body is presented.

A. De G., a man, aged 39 years, on March 18, 1942, while hitting a chisel with a hammer, felt a piece of steel strike his right eye.

Examination revealed the following findings: Vision without correction: O.D., 20/70; O.S., 20/20. Vision with correction: O.D., 20/40 plus 2; O.S., 20/20. The patient was wearing O.D., -0.75D. sph.; O.S., -0.50D. sph.

External examination showed a linear scar on the cornea, which penetrated vertically through its entire thickness. The anterior chamber was intact, and on the anterior capsule of the lens there appeared to be a small linear opacity, which

under the slitlamp was seen to extend into the nucleus. A small glistening object, thought to be the foreign body, was seen. Ophthalmoscopy revealed an opacity of the lens. The patient was admitted to the New York Eye and Ear Infirmary. X-ray studies localized a radio-opaque foreign body in the lens. On March 20th, the foreign body was removed by means of a giant magnet. It was first brought into the anterior chamber by applying the magnet to what had been the path of entry. The anterior chamber was opened at the limbus with a keratome and the foreign body brought out through the incision with a hand magnet.

The patient was put on atropine, vitamin-B complex, and vitamin C, and treated for a month. By this time the eye was white and with -0.50D. sph.  $\approx$  -0.50D. cyl. ax. 75° the vision was 20/30. One year later, on April 1, 1943, the right eye with -1.25D. cyl. ax. 75° still had 20/30 vision.

Two of the most important arguments in favor of the early removal of intralenticular foreign bodies are (1) the prevention of complete opacification of the lens, and (2) the prevention of siderosis bulbi. It is commonly thought that when lenticular foreign body is diagnosed, it is best to wait until the traumatic cataract has become mature and then remove the foreign body along with the cataract. Frequently, when the anterior capsule of the lens is injured, the aqueous is absorbed by the lens fibers, which then become swollen and disassociated, forming a traumatic cataract. In some cases, however, if the foreign body is removed early, the torn anterior capsule will coapt quickly and heal without permitting the aqueous to penetrate the lens fibers. Moreover, the presence of a metallic foreign body in any part of the eye leads to the deposit of iron pigment throughout the entire eye. The prevention is early removal.

\* Read before the New York Society for Clinical Ophthalmology on February 7, 1944.

This case is presented as a demonstration of the advisability of early removal of lenticular foreign bodies. In this instance, the anterior capsule had been ruptured and the foreign body had lodged in the lens. Early removal of the foreign body resulted in the formation of a localized lenticular opacity only. The lens did not become completely opaque. There was no evidence of siderosis bulbi. The visual result was extremely satisfactory. The patient is able to see 20/30 with correction and has binocular vision.

737 Park Avenue.

### PENICILLIN IN THE TREATMENT OF PURULENT CONJUNCTIVITIS

ALBERT N. LEMOINE, M.D., AND ALBERT N. LEMOINE, JR., M.D.

*Kansas City, Missouri*

Since penicillin is not secreted in the tears,<sup>1</sup> one cannot expect its full effectiveness in conjunctival infections by either intramuscular or intravenous administration. The Oxford group,<sup>2</sup> in 1941, reported four cases in which sodium penicillin was used as drops into the eyes with excellent results. In 1943, Florey and Florey<sup>3</sup> treated a small series of cases using calcium penicillin as drops and ointment, with good results.

With these facts in mind, as well as the limited supply of penicillin, one case of purulent staphylococcus conjunctivitis was treated with local instillation of sodium penicillin as drops, and is herewith reported.

R. V. M., a male infant, aged 25 days, born six weeks prematurely, was first seen at home on March 6, 1944. The mother stated that a profuse purulent discharge in both eyes had begun a day after birth. During the last 24 days, the child had been treated, at first with hourly ir-

rigations of boric acid and argyrol. Two unknown drugs were also used in the eyes during this period. During the last week, the eyes were irrigated only every three hours, but the lids were always adherent with purulent discharge after 30 to 60 minutes. The general condition was fair considering the prematurity of the patient.

*Examination.* All four lids were congested, swollen, and sealed shut with a thick, yellow, purulent discharge which had formed an external dry crust. On opening the eye, a large quantity of pus ran out of both eyes. The conjunctiva was extremely congested, but the cornea of each eye was clear. A smear made from the discharge revealed gram-negative, biscuit-shaped, intracellular diplococci with a few gram-positive cocci.

The infant was sent to the City Isolation Hospital for treatment. On admission, the culture made from the secretion from the eyes revealed hemolytic and non-hemolytic *Staphylococcus* and hemolytic and nonhemolytic *Streptococcus*. The general examination was negative, except that the patient was quite emaciated, weighing 5 pounds and 10 ounces.

*Treatment.* The eyes were irrigated with a saturated solution of boric acid every half hour, followed by several drops of 5-percent sodium sulfathiazole solution. Sulfathiazole was given orally, 2 gr. every six hours.

On March 9, 1944, no gonococcus was found by smear or culture. The culture was positive for only hemolytic *Staphylococcus*. The discharge was still profuse, requiring irrigations and sulfathiazole at half-hour intervals.

Nine days later, because there had been no apparent progress in this case, the sulfathiazole was discontinued. Cultures were still positive for hemolytic *Staphylococcus*. The patient was skin tested with staphylococcus antitoxin and was found

to be very sensitive to it; therefore no antitoxin was given.

On March 20th, the discharge was not quite so marked, necessitating irrigation at hourly intervals to keep the lids from adhering. The latter were congested and swollen and the conjunctiva markedly congested. A solution of sodium penicillin in normal saline containing 700 Florey or Oxford units per cubic centimeter was prescribed for use as local treatment, two drops of the solution being instilled into each eye every hour, after the eyes had been thoroughly irrigated with a boric-acid solution. A culture positive for hemolytic *Staphylococcus* was obtained from each eye at 6:00 p.m., and the medication was started at 7:00 p.m. Cultures were ordered every six hours before the eyes were irrigated.

On the following day, at 12:00 a.m., the cultures taken after five hours of treatment with penicillin were positive for hemolytic *Staphylococcus* in both eyes. The 6:00 a.m. cultures from both eyes were positive for hemolytic *Staphylococcus*, but the discharge had practically ceased. The 6:00 p.m. culture was negative and there was no discharge, so irrigations were discontinued, but the instillation of penicillin was continued every hour.

On March 22, 1944, at 12:00 a.m., one colony of hemolytic *Staphylococcus* was

found in the culture from the right eye; the culture from the left eye was negative. All subsequent cultures, taken at six-hour intervals until March 24th, were negative. In other words, there was only one colony after 17 hours of treatment, and no positive cultures 24 hours after the treatment with penicillin was initiated.

On the following day at 12:00 noon, the administration of penicillin was stopped. The eyes appeared normal and were normal at the time the infant was discharged from the Hospital, on March 26th.

A disadvantage in using sodium penicillin is that it is not very stable, but we had the good fortune of having a fresh solution prepared every few hours for another patient who was being treated at the same time, thereby keeping a fresh supply for our patient. Calcium penicillin is more stable and would be preferable for local treatment of conjunctival or corneal infection.

The successful treatment of one case does not prove anything, but the results were so spectacular in this case, which had been resistant to other treatments, that we felt it worth reporting.

We are indebted to Mrs. Dorothy D. Seely for her work on the bacteriology in this case and to Dr. Blaine Z. Hibbard for his constant observation of the patient.

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# SOCIETY PROCEEDINGS

EDITED BY DR. DONALD J. LYLE

## COLORADO OPHTHALMOLOGICAL SOCIETY

May 15, 1943

DR. C. A. RINGLE, *president*

### DOUBLE HYPERPHORIA

DR. GUY HOPKINS presented the case of A. A. M., aged 34 years. This patient was first seen on November 19, 1941, during a routine examination for an aviation certificate.

The vision in the right eye was 20/25, improved to 20/15 with  $-0.25D.$  sph.  $\ominus$   $-0.50D.$  cyl. ax.  $65^{\circ}$ . The vision in the left eye was 20/20, improved to 20/15 with  $-0.25D.$  sph.

Examination of the muscles showed a left hyperphoria of 8 prism diopters with the Maddox rod, but by means of the cover test a right hyperphoria of 6 degrees and a left hyperphoria of 6 degrees were found. The patient had diplopia in the upper right and upper left temporal fields. The right hyperphoria increased on looking up and to the right. The findings were not constant and varied from time to time.

### SPONTANEOUS HEMORRHAGE FROM IRIS INTO THE ANTERIOR CHAMBER OF THE RIGHT EYE

DR. GUY HOPKINS presented the case of Miss B. C., aged 48 years. She was first seen on April 7, 1943, and complained of a hemorrhage into her right eye with a history of having experienced one year previously a similar attack which occurred after stooping.

Vision in the right eye was 20/80, corrected to 20/25; in the left eye it was 20/60, corrected to 20/20. Examination revealed a blood clot in the anterior

chamber of the right eye extending from the middle of the lower portion of the iris, on a line from the 12- to the 6-o'clock position, upward and on to the anterior lens capsule. The pupil was not dilated at this time.

On April 12th the pupil was dilated, and the iris showed one small posterior adhesion at the 12-o'clock position which was easily broken up with atropine. Examination of the eye was otherwise negative for any pathologic change.

Physical examination was essentially negative. The patient had had a cholecystectomy in 1939. Since that time she had taken bile salts by mouth. She showed some yellowness of the scleras. Her icterus index was 24, coagulation time 35. She had been given Bilron and vitamin K.

The hemorrhage entirely cleared up within a week, and the patient suffered no recurrences.

### COMPLICATED CATARACT OF THE RIGHT EYE

DR. GUY HOPKINS reported the case of G. B., aged 68 years. He was first seen on November 25, 1925, at which time he had a fully developed cataract in the right eye. Vision in the left eye was 20/20. When he was seen again, several months later, there were a few small deposits on Descemet's membrane. Since that time he had been seen at intervals through the years because of various minor complaints and for changes in his glasses. The left eye always remained normal.

On July 18, 1942, he returned, stating that the cataract in the right eye had become more noticeable. The pupil was dilated and fixed. The iris was atrophic, and the lens was dislocated. He was



placed on pilocarpine and observed. In August, 1942, he returned with an acutely inflamed and painful right eye. He had accidentally struck his eye the preceding day.

Examination revealed secondary glaucoma. The tension was 60 mm. Hg (Schiötz), and the anterior chamber was filled with blood. Under rest and miotics the tension returned to 26 mm. Hg and remained at about this level except for two very slight flare-ups.

#### INTRAOCULAR FOREIGN BODY

DR. C. E. EARNEST presented the case of C. P., aged 26 years, who gave a history of having sustained an injury to his right eye about two years previously. The patient reported for examination upon his discharge from the Army with a diagnosis of a piece of steel in his eye. X-ray examination of the eye was made and an extracapsular lens extraction performed. The rusty area in the cataract was then tested with a magnet and found to be magnetic. This particle of steel, however, was so small that it was absolutely impossible to remove without extracting the lens. A marked siderosis was present.

This case was reported because it showed how an extremely fine piece of steel can be missed even with X-ray examination, since there are many metals that do not show in X-ray pictures.

#### OCULAR INJURY

DR. C. E. EARNEST reported the case of M. I. S., a civil engineer, aged 36 years. On February 21, 1935, while inspecting in an ore mine, dynamite exploded, injuring his eyes and face and knocking him into a hole, 10 or 15 feet deep. He had a traumatic cataract of the right eye, with multiple lesions of the cornea and iris, and fine particles of ore in the anterior chamber, posterior chamber,

and vitreous. A cataract extraction was performed and, with correction, the patient was able to resume his regular work, even though many particles of ore remained in the eye. This case was reported because ore does not show on X-ray pictures and also because ore is nontoxic.

A number of other cases had also been observed previously. One patient, seen about 13 years ago, had sustained several injuries with tattooing of the cornea and multiple particles throughout the eyeball. He had had cataract extraction and iridotomy, and, with correction, vision was 20/100. The patient resumed his work although he still had particles of ore in his eye. The vision in the left eye was 20/20.

#### POSSIBLE OCULAR TUBERCULOSIS IN OLD INJURED EYE

DR. C. E. EARNEST presented the case of Mr. P. J., aged 28 years, who was first seen on September 11, 1941. He stated that many years ago he had suffered an injury to his left eye. Since that time vision of this eye had been impaired. In the past few months vision in the eye had rapidly decreased. The right eye was normal, vision 20/17. The left eye was slightly reddened, and there was some scleral injection. The cornea was clear, but there were numerous precipitates on the posterior surface. The iris was not congested. The pupils were equal in size, measuring about 4 mm. in diameter, and reacted well to light and accommodation. There were, also, numerous small gray nodules seen with the slitlamp. The lens was clear. There were numerous opacities in the vitreous. The disc was apparently normal but indistinct, and extending into the vitreous was a semitransparent body.

Above the level of the upper margin of the disc there was a whitish mass, practically without prominence. The visual

fields, transillumination, and tension were normal. There was also an old lesion of the lung suggestive of tuberculosis. A tuberculin test was negative.

On September 23, 1941, the left eye was fairly quiet. The posterior surface of the cornea was almost covered with precipitates. There was an exudate along the margin of the pupil. The fundus was very indistinct and the opacities in the vitreous were more numerous. The vision was the ability to count fingers at 10 feet. X-ray treatment was given to the left eye.

During the next six months X-ray therapy was continued at various intervals. The eye became quiet, but there were some cataractous changes in the lens. There was no change in the vision.

The diagnosis was probable tuberculosis of the left eye.

#### QUESTIONABLE OCULAR TUBERCULOSIS

DR. JAMES M. LAMME presented the case of Mrs. A. T., a 49-year-old bookkeeper, who awakened one morning with definite loss of vision in her left eye. She had suffered no headaches nor premonitory symptoms. The lids, conjunctiva, and cornea were normal in each eye. The pupil of the right eye measured 4 mm., that of the left eye measured 5 mm., and the reflexes were slightly sluggish. The vision, R.E., was 20/35-1, improved to 20/20 with correction. The vision, L.E., was 20/100, unimproved with correction. There was no objective pathology found in the right eye.

The fundus of the left eye showed edema and petechial hemorrhages around the disc, which was rather indistinct. There was generalized edema of the retina. There was a massive fan-shaped hemorrhage from the superior temporal vein which extended almost to the ora serrata. A presumptive diagnosis of optic neuritis was made.

A thorough physical examination, X-

ray and complete laboratory tests, which included blood and spinal-fluid examination, were negative.

The patient was given potassium iodide and theelin, and bed rest was advised. One month later the vision was still 20/100 and the fundus findings were unchanged. When examined again, one month later, the acute process appeared to be subsiding. The patient was allowed moderate exercise and advised to stop taking the potassium iodide. In December, 1942, dental examination revealed five infected teeth, and these were extracted. Examination of the fundus at this time showed a definite exudate surrounding an irregular and obscured superior temporal vein. There were small veils of exudate over the nerve head, and very marked vitreous opacities were present. The patient was advised to resume taking the potassium iodide, and in February, 1943, a definite clearing of the fundus was noted; the vision was R.E. 20/20, L.E. 20/35-2. Two weeks later the patient started working and continued with the theelin injections every second week.

Examination in April, 1943, showed that the fundus landmarks were completely obliterated by recent swelling and massive hemorrhage around the nerve head. Treatment as outlined during the first attack was resumed. These observations prompted a presumptive diagnosis of tuberculosis.

Walter A. Ohmart,  
*Secretary.*

#### ROYAL SOCIETY OF MEDICINE

##### SECTION OF OPHTHALMOLOGY

June 11, 1943

MR. F. A. JULER, *president*

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#### BAND KERATITIS

MR. O. G. MORGAN presented a case of idiopathic band keratitis in an otherwise perfectly healthy pair of eyes. The patient was a man, aged 76 years, who gave a history of a gradually increasing corneal opacity for at least six months. There was no evidence of any intraocular inflammation or degeneration. In the right eye vision was less than 6/60, and the band extended across the pupillary area. In the left eye there was a small notchlike clear space just in the pupillary area through which he obtained 6/18 vision. He had not at any time been engaged in work which might have produced a chronic irritation of the eyes. As the disease was in Bowman's membrane and beneath it, optical iridectomy in the poorer eye would seem the most satisfactory form of treatment, especially if the visual acuity in the better eye continued to fail.

*Discussion.* Mr. Humphrey Neame said that when such a band was definitely calcareous he had found improvement by curetting.

Mr. F. A. Juler said that he had had two or three of these cases which had improved by curetting the central area.

Major E. F. King asked whether a corneal graft had been considered.

Mr. Maurice Whiting said that it might be worth while considering the question of performing tarsorrhaphy in the better eye. Exposure of the cornea in the palpebral aperture had an important effect in the production of band opacities, and if a tarsorrhaphy were done in this case it was possible that the opacity might be prevented from becoming more extensive.

Mr. J. H. Doggart said that he had observed several cases of bilateral band-

shaped keratitis not associated with any inflammation, and those which were scraped very soon relapsed. The only two procedures which might help in this case seemed to be (1) an optical iridectomy, and (2) a corneal graft.

Air-Commodore P. C. Livingston wondered whether these cases had any nutritional element in them. It seemed worth while giving large doses of vitamin C intravenously. In somewhat similar cases he had seen doses of 500 to 1,000 mg. result in improvement. For some unexplained reason the substance seemed to reach the cornea in a more beneficial form by intravenous injection.

Mr. O. G. Morgan, in closing, said that he was quite certain that this condition involved the cornea more deeply than the epithelium. He said he might try vitamin C intravenously, since it could be done fairly quickly, but he felt that iridectomy was the most satisfactory treatment in this case.

#### BILATERAL BUPHTHALMOS WITH CONGENITAL ANOMALIES OF IRIS AND SUBLUXATED LENSES

MR. V. B. PURVIS presented A. B., a 23-year-old male laborer who had bilateral buphthalmos along with a most unusual condition of the iris, corectopia, and iris dehiscence, with subluxation of lenses.

The patient first appeared at the hospital one month ago complaining that his vision had been defective since birth but had become progressively worse during the last six years. He also stated that for the past few weeks he had been seeing rainbows. Examination showed that the cornea of each eye was larger than normal. He had a moderate amount of myopia and wore -8.00D. sph. lenses. The vision in the right eye was reduced to the perception of hand movements, and in the left eye with glasses to 5/60.

The tension in each eye was elevated to 50 mm. Hg (Schiötz). The corneas were clear and there were only one or two ruptures of Descemet's membrane in each eye. The discs were grossly cupped and pale. The visual field in the right eye was impossible to chart because of loss of fixation, and in the left eye was reduced to within 5 degrees of fixation with a 10-mm. object at 330 mm.

The main points of interest in this case were the ectopic pupils, which were displaced in an unusual direction down and out, and the splits in the mesoderm of the iris. Only one of these splits (in the right eye) was complete, in that there was an accompanying tear of the ectodermal layer of the iris through which a red reflex was obtainable. The condition was not one of true polycoria in which the accessory pupils each had their own individual sphincters.

The case has not responded to eserine therapy and it was decided to perform an iridencleisis in each eye.

#### DETACHED RETINA, QUESTIONABLE CAUSE

MRS. V. M. ATTENBOROUGH reported the case of a four-year-old boy who was first seen in February, 1943. He complained that for the past two days he could not see with his right eye. Four months previously he had had whooping cough. The mother stated that he had also sustained a fall some time ago. Examination revealed a retinal detachment of the right eye with what appeared to be a disinsertion from the 3- to the 6-o'clock position. The eye was quiet. There were no keratitic precipitates, no synechiae, and no obstruction to transillumination.

*Discussion.* Mr. R. A. Greeves suggested that this was a case of Coats's disease. In various places behind the retina there were areas composed of a

dense, yellowish-white substance, the appearance of which suggested massive exudates. The vitreous was clear and this, in his opinion, excluded the diagnosis of an inflammatory condition. Detachment of the retina, such as was present here, is common in the later stages of Coats's disease. He would not advise excision.

Mr. Humphrey Neame proposed an alternative diagnosis; namely, a rather unusual endophthalmitis, with the retina very much detached. In one such case, in which the eye was excised, the retina in the posterior part of the eye was pulled forward very much by the tissue strands in the vitreous.

Mr. O. G. Morgan said that because the chance of retention of this eye in the future was very doubtful and, since the pathology was certain, he would recommend enucleation. He cited a similar case in which he eviscerated the eye. It turned out to be a sarcoma and the child died of extension some months later.

#### PROGRESSIVE PARTIAL THROMBOSIS OF THE CENTRAL RETINAL VEIN

MR. P. D. TREVOR-ROPER (on behalf of Mr. P. G. Doyne) presented the case of a woman, aged 36 years, who in November, 1942, saw black spots in front of her left eye, lasting about one hour. In May, 1943, she noticed black spots again, followed by slight mistiness which gradually disappeared during the next few days. On admission to Moorfields on the next day the right eye was found to be normal and the vision was 6/5. In the left eye the vision was 6/5 and the eye was normal except for the fundus, which showed dusky and engorged veins and a swollen and blurred optic disc. There were two minute hemorrhages along the inferior nasal vein and one near the macula. A course of heparin injections

was given and seven days after admission the patient was discharged. The left eye showed the same condition of the veins as when first seen; increased swelling of the disc with several small hemorrhages around it, and absorption of the small hemorrhages along the inferior nasal vein. When seen on June 1, 1943, the hemorrhages had increased and the papilledema had become more marked. There were at this time about four small hemorrhages around the macula and a dozen scattered along the retinal vein.

A Wassermann test was negative. X-ray examination of the chest was negative. Physical examination showed no abnormality except rather low blood pressure (100/80) on separate occasions, and dental sepsis.

The case was of special interest in view of the slowly progressive nature of the fundus changes resulting from partial central-vein thrombosis; and also in condemning the use of heparin, which was shown to be of no avail even when the thrombosis was in its earliest stages.

*Discussion.* Mr. F. A. Williamson-Noble said that he thought this was a thrombosis because the slightest amount of pressure on the unaffected eye caused venous pulsation, whereas if one pressed on the unaffected eye there was no venous pulsation until sufficient pressure had been exerted to elicit arterial pulsation, at which time the vein collapsed in the same quick way as the artery.

#### CHORIORETINITIS ASSOCIATED WITH TOXOPLASMA

COL. DERRICK VAIL (MC), A.U.S., presented a paper on a type of chorioretinitis which is produced by the toxoplasma parasite. A brief history of the toxoplasma was given which included its habitat and host. The method of invasion of the host is unknown at present. Lab-

oratory tests reveal a number of experimental means of transmission of the parasite. A description of the parasite followed.

The infestation affecting the eye was first reported in 1923 by Janku. Since then a few others have reported cases. A résumé of these findings was given.

In the cases described the ophthalmologic examination revealed in both the infantile and adult cases the familiar circumscribed exudative choroiditis. There is a predilection for the macular area, and the lesions are usually bilateral and multiple. Activity of the lesion is characterized by choroidal hemorrhage, usually in the direction of the extension of the lesion. Healing is shown by pigmentation, sometimes accompanied by proliferative retinitis and in one case retinal detachment.

In 11 of the cases described the condition was probably congenital, in the twelfth it was without doubt acquired. Three additional cases occurring in adults past the third decade, under Colonel Vail's observation, have not yet been reported. These are probably acquired cases of toxoplasma.

Iridocyclitis with corneal precipitates has been found twice; vitreous opacities may or may not be present.

The diagnosis in congenital cases can be made by the clinical tetrad of symptoms as described by Sabin. This is: (1) hydrocephalus or microcephalus; (2) cerebral calcification; (3) chorioretinitis; and (4) disturbances of nervous function.

Koch and his associates believe that the intraocular lesions of toxoplasmic encephalitis have certain characteristics that seem to distinguish them from other forms of choroiditis. Among these are, regularity of bilateral involvement of the macular region, tendency to bilateral oc-

currence of other than ocular lesions, presence of massive chorioretinal degeneration, extensive connective-tissue proliferation and heavy pigmentation, tendency to the occurrence of associated congenital defects in the eyes, and constant clarity of the media in the presence of severe chorioretinitis.

However, in Colonel Vail's opinion, there is nothing in the ophthalmoscopic appearance of the lesions that is characteristic, at least in the older children and adults under his observation, provided one accepts the validity of the laboratory test as the diagnostic yardstick.

More studies are needed to prove the validity of the toxoplasma neutralization test. Up to the present the test seems most promising and accurate. Sabin's studies unfortunately have been interrupted by the war, but in a recent article he has described 151 individuals suspected of toxoplasma infection, 59 of whom gave positive neutralization tests for toxoplasma. It is significant that in 9 out of 10 cases in which the sera contained neutralizing bodies for toxoplasma, the only clinical manifestation was that of a chorioretinitis of unknown etiology with a predilection for the macular region. Sabin had also found that occasionally the serum of the mother and less frequently the serum of the father or older siblings was also positive.

The spinal fluid or heparinized blood or both are injected into mice and guinea pigs by the intracerebral and abdominal routes. Using rabbits, neutralization tests can also be made with human sera. For details of these tests, reference should be made to Sabin's article.

*Conclusion.* Cases of chorioretinitis in infants in which the toxoplasma parasite has been found microscopically have been described. Other cases in older

children and adults whose sera contained neutralizing bodies for toxoplasma are mentioned in the literature. This new etiologic concept is important enough to stimulate further study.

## COLLEGE OF PHYSICIANS OF PHILADELPHIA

### SECTION ON OPHTHALMOLOGY

October 21, 1943

DR. ALFRED COWAN, *chairman*

#### MEMOIR OF DR. GRISCOM.

DR. CHARLES R. HEED delivered this tribute.

#### DRUSEN OF THE OPTIC NERVE SIMULATING BRAIN TUMOR

DR. J. WALDMAN and (by invitation) DR. N. S. SCHLEZINGER and DR. B. J. ALPERS presented a paper in which the anamnestic data in two cases of optic-nerve drusen were described and revealed a clinical syndrome chiefly characterized by headache, vomiting, and an altered appearance of the optic discs somewhat suggestive of early papilledema. The diagnostic possibility of a brain tumor was seriously considered in both cases. The result of intensive clinical investigation, including pneumoencephalography, made evident the fact that the symptoms in these patients were not due to brain tumor.

A review of the literature discloses that the origin of optic-nerve drusen is as yet not clearly defined. The consensus of opinion favors the hypothesis that drusen arise from abnormal hyaline secretions of the proliferated neuroglia in the papilla. The occurrence of optic-nerve drusen without symptoms is well known, and their association with ophthalmologic diseases such as retinitis pigmentosa, glaucoma, melanosarcoma, and so forth, has

been pointed out. The relatively frequent concurrence of drusen of the optic nerve with neurologic disorders is considered in some detail. Particular attention is directed toward the relatively frequent appearance of headache as a conspicuous symptom in some patients with optic-nerve drusen. Such patients demonstrate the fact that this generally benign neuro-ophthalmologic disorder may sometimes be characterized by symptoms and signs which closely resemble those ordinarily associated with brain tumor. Conspicuous among these clinical manifestations are: (1) headache; (2) obscuring of the optic disc with, at times, elevation of the optic disc; and (3) various visual-field alterations, usually including enlargement of the blind spot.

*Discussion.* Dr. William Zentmayer said that he thought that cases showing the accumulation of hyaline bodies *en masse* on the head of the optic nerve are especially rare, and make it worthwhile reporting such cases. He had two such instances that he wished to put on record. The first patient was a 23-year-old woman who was referred in May, 1942, by an ophthalmologist in Florida. She had been under his care since July, 1928. In 1931 there was an appearance of pseudopapillitis, but it was not until 1939 that the present condition in its incipency was noted. In April, 1942, the ophthalmologist's notes detailed an accurate description of the condition. The visual fields were contracted and showed a number of reëntering angles. Suspecting some organic trouble, he had a thorough physical examination made which revealed some kidney disturbance, the exact diagnosis of which was not stated, but there was a persistent high albumin with blood cells.

The patient was normal mentally, and presented no physical defects. The corrected vision was R.E. 6/4, partly; L.E. 6/6, partly. The intraocular pressure was

a low normal. In the right eye, the media were clear, and on the upper portion of the disc there was a mass of hyaline matter resembling a "white mulberry." The mass lay beneath the vessels, and there was some extension onto the retina. In the left eye, the appearance of the disc was similar, but not so conspicuous as in the right eye. In both eyes the retinal arteries were too bright.

The visual fields showed considerable irregular contraction with great enlargement of the blind spot; the right field presenting several reëntering angles, and the left field but one. There could be but little doubt that the condition was drusen of the nerve head. The visual-field anomalies have been noted before by others, the explanation is that the mass makes pressure on the retinal fibers as they emerge from the disc. As the history seemed to indicate that the condition was recently acquired and progressive, there is a remote possibility that the central vision might later be impaired by pressure on the papillo-macular bundle of fibers.

The second case was, one might say, more spectacular. The patient was a nine-year-old boy, referred by an ophthalmologist in New Jersey. The history was negative. The child was somewhat undernourished, but there was no history of convulsions; his mentality was good, and there was no adenoma sebaceum. In the right eye the media were clear. Covering all but a narrow rim of the optic papilla, and extending somewhat below the lower border of the papilla onto the retina, was a heap of hyaline globular bodies, varying in size, but averaging about the diameter of a retinal vein, the larger ones being at the lower portion of the mass, giving the whole the appearance of a "white mulberry." The spheres were almost transparent, and projected 5 diopters into the vitreous. The fundus level was emmetropic. At the temporal border of the disc,



the crystals were banked in two levels, and, between the two, the inferior temporal vein emerged. The nasal vein was pushed up somewhat at the edge of the disc. The rest of the fundus was normal. After homatropine had been instilled, the vision in the right eye, without correction, was 6/6.

The fundus of the left eye presented no anomalies. No recent notes regarding the progress of these cases were made. Mass drusen of the nerve are rather uncommon, and this is shown by the fact that the men who saw the two cases had many years of experience in ophthalmoscopy, but apparently neither of them had ever seen such a case.

In regard to the first patient, the notes showed a pseudo-optic papillitis. As the patient was under observation for several years before the appearance of the hyaline masses on the disc, it is possible that the pseudopapillitis observed in 1931 was due to the presence of these hyaline masses in the optic nerve, and that later the increase became apparent on the surface of the papilla.

He said he believed there should be no difficulty in making a diagnosis in these cases, although in tuberous sclerosis the gross ophthalmoscopic appearances are similar, in some instances they have been described as "mulberry like," and should there be but a single lesion involving the nerve head, there would be a close resemblance. However, the general symptoms of tuberous sclerosis at once clear up the diagnosis.

Dr. N. S. Schlezinger, in closing, said that he would like to add one thing, that it is the case in which the drusen are more deeply situated, and in which the appearance of the fundus resembles a pseudo-neuritis that creates a problem from the neurologist's standpoint. In such cases there may be some elevation of the optic disc and some enlargement of the blind

spot, but no drusen visible ophthalmoscopically. He said he thought that these present a difficult diagnostic problem especially if they are associated with the type of headaches that were such a conspicuous complaint in the second case he described.

#### MASSIVE SKIN GRAFT

DR. E. B. SPAETH gave a moving picture demonstration which illustrated some of the rather important factors connected with a free-skin graft. The picture presented a patient with a tremendous keloid in the whole right eye which was in a terrific state of ectropion from keloid and contraction.

An attempt was made subsequently for corneal grafting, but this proved unsuccessful because of the tremendous thickening of the cornea accompanied by a severe iridocyclitis. Insofar as the skin graft was concerned, it was simply a matter of improving the cosmetic appearance of the child.

#### JUNIUS KUHN MACULAR DEGENERATION

DR. SAMUEL ALTMAN presented a paper on this subject.

*Discussion.* Dr. Charles E. G. Shannon stated that he had been permitted to examine the patient and there were two features that impressed him and that were brought out by Dr. Zentmayer in a recent discussion of this case. First, that the macular degeneration should occur in a man 34 years old (the juvenile type—that is extremely rare); and, second, the opportunity of noting the early or hemorrhagic stage in the right eye and its full development in the left.

Dr. W. Zentmayer stated that it must be rare to be able to observe the initial stage and the final stage of this condition in the same patient, so that Dr. Altman's case was a very instructive one.

As to the origin of the fibrous tissue,

it was long held that it arose from the hemorrhages. Later, Verhoeff found that the pigment epithelium of the retina was also a factor in the production of the new-formed tissue.

Dr. Samuel Altman, in closing, said that it seemed that in these cases, once the damage is done, and vision reaches a certain level, the condition remains stationary.

Warren S. Reese,  
*Secretary.*

## NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

October 4, 1943

DR. SIGMUND A. AGATSTON, *presiding*

### CONTACT LENSES

MR. THEODORE OBRIG presented a kodachrome film on this subject during the instructional hour.

### A NEW METHOD FOR TESTING MACULAR FUNCTION

DR. MAX GOLDSCHMIDT pointed out that in any beginning affection of the macula, confusion may exist between a macular lesion and retrobulbar neuritis. He quoted Duke-Elder as saying "the clinical picture of the retinal edema in its milder aspects is frequently difficult to detect; even with Vogt's red-poor light and Evans's method of scotometry, the finding of a macular edema is difficult or even impossible."

These difficulties may be overcome by applying the phenomenon of Haidinger's brushes for the examination of the macula. This phenomenon is elicited by gazing through a polaroid glass or a Nicol's prism which is rotated before a regular white plane or the blue sky. The eye sees two bright patches, bluish in color, bordered by two hyperbola, between which are the characteristic yellow brushes. The

figure rotates with the polaroid glass. To facilitate the observation of the brushes, Dr. Goldschmidt combined the polaroid glass with a blue-glass filter and the patient looks through a tube at a milk-white plane glass illuminated from behind.

The ability to see the Haidinger's brushes is relatively independent of the visual acuity and the state of refraction, but requires the integrity of the macula. Examination of the average patient or older child is not difficult, but where there is involvement of both eyes, or the patient has only one eye, there must be sufficient intelligence to understand the procedure.

The phenomenon is dependent upon the arrangement of the fibers of Henle's layer which parallels the external limiting membrane and acts as a polarizer; the polaroid glass acting as an analyzer. The slightest change, structural or physiologic, results in loss of this faculty. It is therefore possible to apply the Haidinger's brushes in cases where there is questionable lack of the fovea, the slightest pathologic change in the fovea, or for differentiation between the earliest stages of macular disease and retrobulbar neuritis.

The brushes could not be seen in cases of albinism with nystagmus. In alternating strabismus they could be seen with either eye and with the fixating eye in monocular strabismus, but only some of the patients in latter cases saw them with an amblyopic squinting eye. These had improvement of vision on prolonged occlusion, but amblyopic eyes which could not see the brushes did not benefit by occlusion of the other eye. A patient having retinal edema, discernible with the Gullstrand ophthalmoscope but not the monocular ophthalmoscope could not see the brushes. However, they were seen when the edema subsided and were lost again upon recurrence.

The brushes are never absent in retrobulbar neuritis except where there is an

absolute central scotoma and marked visual loss. Their presence or absence proved of value in differentiating between this condition and early macular disease.

Other applications of this test, which Dr. Goldschmidt suggests calling *Haidinger's polarization test of the fovea centralis*, will be reported later. These concern the influence of drugs on the macula, the measurement of intraocular capillary pressure, and the possibility of an early diagnosis of glaucoma.

*Discussion.* Dr. E. Waldstein pointed out that gazing through a pinhole in a piece of moving cardboard enables one to see the vascularization about the macula. An intelligent patient with one normal eye should be able to observe the difference between it and an eye with a disturbance in the vessels.

Dr. Goldschmidt pointed out that the observation Dr. Waldstein mentioned does not help in examining the macula itself, but rather the endings of the blood vessels.

#### CONTACT GLASSES IN DIAGNOSIS

DR. JOHN McLEAN discussed special uses for contact glasses in diagnosis. The spherical segment ground glass may be used to eliminate corneal astigmatism in the determination of lenticular astigmatism. The same type of glass is sometimes useful in obtaining a clear view of the fundus in keratoconus and other conditions of corneal aberration which distort the ordinary ophthalmoscopic picture. The glass with four lead dots at the limbus is well known for its use in X-ray localization of intraocular foreign bodies. The flat-surfaced contact glass which optically eliminates the anterior corneal curvature renders the fundus and posterior vitreous visible for slitlamp examination. Such technique, however, requires close approximation of the illuminating and visual axes and permits only a monocular picture.

A gonioscopic contact glass is the only absolute necessity in the way of gonioscopic equipment. For ordinary clinical use complicated gonioscopes are not necessary, and a variety of illuminating and magnifying devices can be used. Gonioscopy is not confined to the study of glaucoma. It is also of great clinical value in the study of anomalies of the anterior chamber and its angle; the discovery and localization of small foreign bodies in the angle; the study of the angle in inflammatory processes; tumors of the angle, iris root, and ciliary body; and in postoperative studies after all types of intraocular surgery.

In the study of primary glaucoma it was pointed out that gonioscopy may not be relied on for early diagnosis because the majority of early cases do not show changes in the angle. However, the selection of the best type of operation and the right site for it is best done with the aid of gonioscopy.

In congenital glaucoma the type and extent of congenital anomaly of the filtration structures is disclosed by gonioscopy and treatment may be undertaken accordingly.

In postoperative glaucoma, particularly following cataract extraction, glaucoma may often be suspected before any other signs are manifest by study of the angle. This procedure reveals early changes in patients who must be watched and treated for potential postoperative glaucoma.

Various other types of glaucoma can be discovered and understood, such as, glaucoma capsulare, diabetic rubeosis, and glaucoma following central venous occlusion.

In unsuccessful glaucoma operations gonioscopy is often useful in diagnosing the cause for surgical failure so that it can subsequently be avoided.

#### SLITLAMP STUDY OF THE VITREOUS

DR. MILTON BERLINER discussed the biomicroscopic examination of the vitre-

ous and the limitations of the ordinary slitlamp and microscope. Methods of overcoming these difficulties to enable visualization of the posterior vitreous were described. The normal vitreous as well as various pathologic changes were considered and slides were presented illustrating these as well as other aspects of the paper.

#### DIAGNOSTIC VALUE OF PUPILLOGRAPHY

DR. OTTO LOWENSTEIN said that pupillography is a method of simultaneously recording the pupillary movements of both eyes under the condition of darkness by means of an infrared-light filter. It is a diagnostic system based on the results obtained by that method. Routine pupillographic examination includes the study of the reactions to: 1) light; 2) near and distance vision; 3) darkness; 4) sensory and psychologic stimuli; as well as 5) the pupillary reflex to lid closure, either after tactile stimulation of the cornea or the lid margins, or as spontaneous blinking.

It is the purpose of pupillographic examination to check the integrity of the more or less well-known pathways of nervous control of the pupils, on both the parasympathetic and the sympathetic side.

A short, up-to-date review of the results of pupillographic studies was given showing that pupillography is a kind of microscopic analysis of a living process which enables one to detect phenomena invisible to the naked eye. They are concerned with:

- 1) The early diagnosis and localization of organic lesions of parasympathetic origin. In this group the detection of preliminary stages of the Argyll Robertson pupil seemed to be the most important one, enabling early, really preclinical, detection of symptoms of a syphilitic lesion of the central nervous system and, particularly, observation of its development.

- 2) The vast field, only recently opened by pupillography in the diagnosis of the

sympathetic system, makes it possible to arrive at an early diagnosis within a region hitherto largely unknown and to evaluate many symptoms. This may reveal other conditions, especially neuroses.

*Discussion.* Dr. Mark Schoenberg summarized the findings from 50 cases of glaucoma studied pupillographically with Dr. Lowenstein. Changes were found in all 50 of these cases of glaucoma simplex, not only in established cases but in very early cases, and, even more significant, in the apparently normal eye of patients with clinically unilateral glaucoma. This last finding holds great promise for the future, although it must be realized that it is based on only 50 cases.

Dr. George Kleefeld described studies performed on visualization of the pupil in darkness, using infrared light for observation. These studies were interrupted by the invasion of Holland and await the termination of the war for their resumption.

Dr. Isadore Givner stated that he and Dr. Lowenstein have been investigating Graves's disease pupillographically. The number of cases is small and his remarks were made as a preliminary report. Pupillographic changes are found showing fatigue of the contraction to light, which indicates parasympathetic involvement. In all cases studied, there was a block in the normal redilatation that occurs after contraction to light. This is significant of central sympathetic disturbance. If these findings are confirmed by further work, they will be the first tangible evidence of hypothalamic involvement in Graves's disease and may explain not only cases of widened palpebral aperture with no elevation of the basal metabolic rate, as in postthyroidectomy cases, but also the absence of a dilated pupil in a condition in which stimulation of the sympathetic has long been recognized.

Leon H. Ehrlich,  
Secretary.

# AMERICAN JOURNAL OF OPHTHALMOLOGY

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## THE TRAINING OF BRITISH OPHTHALMOLOGISTS

In view of the coming postwar coöperation between America and Britain, it may be appropriate to study the similarities and differences of ophthalmic education in the two countries. Before taking up the question of ophthalmic residencies, it is necessary to understand the background of general medical education in England.

The prescribed course of medical studies usually covers five years; the 1st year is entirely premedical, the 2d and 3d years are devoted to the regular basic medical studies, and the last two years are occu-

pied with clinical work in a hospital. None of this period is spent as an actual resident, and after graduation it is not compulsory to take an internship, although the majority do apply for the small number of good internships available. No A.B. or B.S. degree is required for admission to medical schools, hence matriculation often takes place at about 17 or 18 years of age following the completion of what would correspond to our high school course. Thus it is possible to begin general practice at the age of 22 or 23. The joint degree of M.B. and Chir. B. (Bachelor of Medicine and Surgery) is granted to

those who have completed the required course of study and passed the necessary examinations. The degree of M.D. cannot be taken until three years later and is given to those who submit a satisfactory thesis on some medical topic. There is also a corresponding degree in surgery, M.S. or M.Ch. (Master of Surgery), granted on the same basis. These higher degrees are purely voluntary and most British practitioners do not possess them.

After completing his medical studies, the young doctor is not faced with the prospect of state board examinations such as exist in the United States. A man qualifies for medical practice as soon as he obtains a degree in medicine and surgery from a university. He simply has to register this degree with the General Medicine Council and can then begin practice immediately anywhere in the United Kingdom. Although some medical schools are considered superior to others, there are no third-rate schools such as we understand them; hence the possession of any university degree in medicine and surgery is considered evidence of qualification to treat the sick.

In addition to the regular university medical degrees, there are several medical diplomas, the possession of any one of which entitles a man to registration as a medical practitioner on exactly the same basis as the holder of a university degree. The first of these is called the L.S.A. (Licentiate of the Society of Apothecaries). This is considered the lowest "degree" in British medicine. It can be taken by those who have not quite finished their university course, since the full five years of medical studies are not required before application is made for this examination. If one is granted the L.S.A. one can theoretically be qualified to practice medicine a short time before graduation from medical school. Should he fail in his final university examinations, a student may

try for the L.S.A. diploma and, if successful, be able to practice while waiting for another try at his university degree. This however is not the usual custom. It should be pointed out, also, that a practitioner who holds only the L.S.A. diploma is not eligible for election to any good medical society nor to the staff of any first-class hospital.

Another of these special medical diplomas is the so-called Conjoint Board Certificate leading to the joint degrees of M.R.C.S. and L.R.C.P. (Member of the Royal College of Surgeons and Licentiate of the Royal College of Physicians). This diploma is conferred after the candidate has successfully passed a comprehensive examination. Here, again, the qualifying period is slightly shorter than the regular university degree, and the standard of the examinations is generally considered lower, partly because the latter may be taken in three or four separate parts instead of all together as is the case in most university degrees.

There are a large number of students in London medical schools who take these Conjoint Board examinations. They do this in order to become qualified a few months earlier than would be possible if they waited for their regular university degrees. They then become eligible to compete at an earlier date for the relatively small number of good hospital appointments (internships) which are available at the big teaching hospitals. About half of them go back later to take their regular M.B. Chir.B. degree at the university.

The Scottish Colleges of Physicians and Surgeons in Edinburgh and Glasgow offer another diploma, the L.R.C.P. and L.R.C.S. (Edinburgh) and L.R.F.P. and S (Glasgow), often called the "Scottish Triple." This is more or less similar to the Conjoint Board Certificate.

The aforementioned are those degrees and



diplomas that entitle a man or woman to begin the general practice of medicine anywhere in the British Isles. For those who wish to specialize in some branch of medicine or surgery it is customary, though not necessary, to obtain further qualification. There is no statutory obligation to obtain higher degrees, but appointments to the staff of most good hospitals are open only to those who do. All good staff surgical appointments, including the best appointments in ophthalmology, require candidates to possess the F.R.C.S. (Fellow of the Royal College of Surgeons), which is open to any registered doctor who can pass the severe examinations in anatomy, physiology, pathology, and surgery, both clinical and operative. These examinations are organized and conducted by the Royal College of Surgeons in England and a corresponding body in Edinburgh. For those wishing to specialize in internal medicine there is a stiff examination offered by the Royal College of Physicians of London leading to the degree of M.R.C.P. (Member of the Royal College of Physicians.) To those specializing in obstetrics and gynecology there is offered an additional degree of M.R.C.O.G. (Member of the Royal College of Obstetrics and Gynaecology), awarded after passing an examination and submitting clinical notes on a certain number of cases.

Those members of the Royal College of Physicians and Royal College of Obstetrics and Gynaecology who attain posts of high authority in certain hospitals and universities may be elected without further examination to the title of Fellow of their respective colleges (F.R.C.P., F.R.C.O.G.).

In addition to these more well-known diplomas and degrees there are a series of others awarded by the Royal College of Surgeons and Royal College of Physicians jointly. These include diplomas in public

health, radiology, ophthalmology, otolaryngology, child health, and anesthetics. Such diplomas can be obtained only by further examination after qualification. In the majority of cases the candidates must have held certain posts in recognized hospitals where they have practiced their specialty for a specified period of time. These special diplomas are quite similar to our American Specialty Board Certificates.

It can be seen from this brief outline that there exists in Britain a graded system of medical education not unsimilar basically to our own. The first difference that strikes one is the early age at which a doctor may begin to practice. Although this undoubtedly lightens the economic burden, the average American would feel that this advantage must be weighed against a lower standard of education in the liberal arts and a certain lack of maturity on starting out to heal the sick. Perhaps only 10 percent of British medical graduates possess an A.B. degree.

The next notable difference is the absence of the compulsory internship following graduation from medical school. About 75 percent of graduates do take a house job of six months' to one year's duration but the remaining 25 percent usually become assistants to well-established practitioners and gradually acquire experience during their apprenticeships.

It should be pointed out again that while standards for general practice seem rather low, the possession of a qualifying diploma alone, such as the L.S.A. or the Conjoint Board Certificate, does not open up to the young doctor opportunities for advancement, for even in the smaller rural hospitals preference is given to the holder of a university degree in medicine. Hence the majority of young medical men do obtain their university degrees.

If one is going to specialize, the requirements are relatively high. Special



residencies are available where good training can be obtained. Then examinations are taken for the Specialist diplomas and later for the high degrees of F.R.C.S., M.R.C.P., or M.R.C.O.G. These latter degrees might be compared in some ways to our own F.A.C.S. and F.A.C.P. except that the British degrees are considered more as real degrees and are only granted after passing very severe examinations at which sometimes more than 50 percent fail.

So much for British medical education in general; we now come to a consideration of their ophthalmic residencies. Although there naturally exist individual differences in the training routines of many ophthalmic institutions, we might take the Royal London Ophthalmic Hospital (Moorfields) as a typical example. This institution, established in 1805 as the first special hospital for the treatment of the eyes in the United Kingdom, is known to many American ophthalmologists. At Moorfields there are four residents known, in order of seniority, as the Senior Resident Officer, and the first, second and third House Surgeons. They are appointed for periods of six months in each of these positions upon recommendation of the medical board. Thus, a man who secures an original appointment, may expect to have a period of two years' training.

Original appointments are made on the basis of previous training, letters of recommendation, and personal interview with the surgeons. Although the only stated requirement is that candidates must be registered medical practitioners, actually there are a number of other factors which determine their selection. For instance, those possessing a university degree are considered before those holding a medical diploma such as the L.S.A. or the Conjoint Board Certificate. Also preference is given to those who have com-

pleted an internship in general medicine or surgery. In addition, practically all appointees have either had a shorter period of ophthalmic training elsewhere, or have worked, under supervision, in the out-patient clinic at Moorfields for a year, and taken various courses there before applying for the appointment. All residents live in the hospital and, in addition to room, board, and laundry, receive a rather generous salary which, in terms of U. S. currency at current exchange rates, is as follows: the 3d House Surgeon \$400, the 2d House Surgeon \$500, and the 1st House Surgeon and Senior Resident Officer \$600 each. Thus, at the completion of the 2-year appointment, a man will have received \$2,100. In addition to this, the Senior Resident Officer is authorized to accept remuneration from the surgeons for assisting them in private operations in the hospital. Also he may collect small fees for attendance in court cases and for making reports on hospital cases when requested. It becomes apparent that the financial remuneration for a resident at Moorfields far exceeds any figure given to American ophthalmic residents. This is rather surprising considering the relatively lower pay scales which exist throughout all phases of military and civil life in England.

The routine of the residents may be outlined briefly as follows:

The duties of the 3d House Surgeon are entirely in the out-patient department. He is kept busy all morning seeing cases referred to him by members of the surgical staff. When required, he assists at minor operations and administers anesthetics to outpatients. In the afternoon he continues to see the overflow from the morning clinic and takes care of all accident cases or other emergencies that may present themselves.

The 2d House Surgeon's duties pertain mainly to in-patients. He has allotted to

his care all public house patients on one floor as well as cases of purulent ophthalmia. He is responsible for keeping the records on these patients, making the daily visit, changing the dressings, and the like. He accompanies the surgeon on his visit and assists him in operations. He may also be called up to assist the Senior Resident Officer or the 1st House Surgeon in surgery, or to administer anesthetics when required.

The 1st House Surgeon takes care of the remainder of the public-ward patients and also the private patients. He makes the visit with the surgeon in charge and assists at operations. It is at this point that he is allowed to do some surgery under supervision.

The Senior Resident officer has general control and supervision of all house patients, both public and private. He is responsible for the work performed by other residents. He attends the surgeons on their visits and assists them in operations. It is during these last six months that the bulk of his operating is done. It has already been mentioned that he also represents the hospital in testifying in court cases and in making out reports for insurance cases.

There is no doubt that a resident of Moorfields is well trained in surgery. The following list of operations performed by a recent graduate during his term of office as Senior Resident Officer and 1st House Surgeon represents the average surgical experience.

<i>Operation</i>	<i>Cases</i>
Cataract .....	100
Trephining .....	50
Iridectomy .....	30
Squint .....	100
Retinal detachment .....	90
Intraocular foreign body .....	35
Enucleation and Evisceration .....	120

The bulk of refraction and perimetry at the hospital is done by paid refractionists. Orthoptics and clinical laboratory

work (blood counts, cultures, urinalysis, and so forth) are taken care of by special technicians. Thus a resident is not bothered by the necessity of performing these details but is free to employ his time in studying his patients. This system has much to recommend it provided the resident has a thorough training in refraction and perimetry beforehand and is able to do enough refractions and fields during his residency to learn the art of these all-important tests as well as the theory.

There is no organized system of instruction during the residency itself. The elements of refraction, perimetry, pathology, and the like, must be learned beforehand. As previously stated, practically all residents before appointment have worked in the out-patient department for a year. Here they have availed themselves of the various courses offered in the afternoons by the school of ophthalmology. The faculty of this school consists of the active and consulting staff of the hospital. A list of these courses is as follows:

Anatomy  
Optics  
Ophthalmoscopy  
Medical ophthalmology  
Operative surgery  
Slitlamp microscopy  
Orthoptics  
Physiotherapy  
Contact-glass clinic  
Physiology  
Errors of refraction  
Pathology lectures  
External diseases of the eye  
Diseases of the retina and optic nerve  
Practical pathology (1 month in lab.)  
Practical bacteriology (1 month in lab.)  
Motor anomalies, Squint, etc.  
Radiography and Radiotherapy  
Diseases of the uveal tract

The total fee for all these courses amounts to about \$175. The completion of this curriculum requires at least six months, and admits candidates to the examinations for the D.O.M.S. (Diploma in Ophthalmic Medicine and Surgery). These courses, which are practical as well

as didactic, combined with observation of patients in the out-patient department and in the house, give a man a good basic training before beginning his residency.

In comparing the British medical-education system to ours one gets the impression that while the training of the English general practitioner may be inadequate, that of the English ophthalmologist is of high quality, as judged by the standards of Moorfields. We might learn much from our English cousins and they from us. The creation of exchange fellowships between the better teaching hospitals of England and America could not fail to be of mutual benefit to ophthalmology in both countries.

Edwin B. Dunphy.

## BOOK NOTICE

**MEDICAL PHYSICS.** Editor-in-Chief, Otto Glasser, Ph.D. 1744 pages. Chicago, Illinois, The Year Book Publishers, Inc., 1944. Price not stated.

This is a very large volume covering most medical and allied specialties; such as, anatomy, bacteriology, biometrics, biophysics, dermatology, and so forth. The section on ophthalmology was written by Albert D. Ruedemann, M.D., Head of the Department of Ophthalmology, Cleveland Clinic Foundation, Cleveland, Ohio. There are also numerous articles having to do with optics. These are edited by W. B. Rayton, D.Sc. It is obvious that in such a compendium as this there are many subjects not under either of the above headings that would have more or less bearing on ophthalmology; such as, neurology, radiology, bacteriology, and so forth.

Among the contributors to ophthalmic and closely related subjects is Dean B.

Judd, Ph.D., who writes on color vision. As one would expect, the physics of the subject is considered in great detail. Colorimetry is discussed, and the theories of Young-Helmholtz, Ladd-Franklin, Hering, and Müller are given in more detail than can be found in any but the most exhaustive treatises. Retinal adaptation is explained qualitatively and quantitatively. Color-vision tests are very thoroughly considered by Elsie Murray, Ph.D.

Light, Vision, and Seeing represents a chapter contributed by Dr. Matthew Luckiesh and the late Dr. Frank K. Moss. Much of this will be familiar to the readers of this Journal, for many of the articles on this subject were published in it.

A chapter on optical illusions contains many interesting figures as well as some history of the subject and theories to explain this by Otto Glasser, Ph.D.

Dan H. Moore, Ph.D., writes on optical methods in electrophoretic and ultracentrifugal analyses.

The application of optics to ophthalmology is the contribution of Dr. Charles Sheard. The consideration of theories is followed by an excellent discussion of bifocal lenses with some suggestions as to factors to be considered in selecting them.

Detailed explanation of fundus photography is Dr. Ferdinand L. P. Koch's contribution to the volume. This includes a description of the Nordenson and the Zeiss retinal cameras, with advice on technique of making the pictures. The physics of vision, especially its photochemistry, is presented by George Wald, Ph.D.

The ophthalmic articles, as would be expected in a book of this character, are of a highly scientific and technical nature and of particular value to any interested in research along these lines.

Lawrence T. Post, M.D.

# ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

## CLASSIFICATION

- |  |   |
|--|---|
| 1. General methods of diagnosis                        | 10. Retina and vitreous                                 |
| 2. Therapeutics and operations                         | 11. Optic nerve and toxic amblyopias                    |
| 3. Physiologic optics, refraction, and color vision    | 12. Visual tracts and centers                           |
| 4. Ocular movements                                    | 13. Eyeball and orbit                                   |
| 5. Conjunctiva   | 14. Eyelids and lacrimal apparatus                      |
| 6. Cornea and sclera                                   | 15. Tumors  |
| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries  |
| 8. Glaucoma and ocular tension                         | 17. Systemic diseases and parasites                     |
| 9. Crystalline lens                                    | 18. Hygiene, sociology, education, and history          |
|  | 19. Anatomy, embryology, and comparative ophthalmology. |

### 1

#### GENERAL METHODS OF DIAGNOSIS

Bean, L. L. A simple night-vision test. U. S. Naval Med. Bull., 1944, v. 43, July, p. 143.

A simple device for the testing of night vision is described. It consists of a box with two compartments. One compartment contains the light source, a 3.8-volt bulb attached to the ship's current. By means of a sliding bar, an aperture between the compartments can be varied in size from  $\frac{1}{64}$  to  $\frac{3}{8}$  inch. This small light source illuminates the ground-glass end of the box, and the criterion selected is the ability of the dark-adapted subject to recognize accurately, with the smallest possible light source (in terms of size of aperture); the position of an opaque arrow on the ground glass.

The test provides no quantitative measurement in terms of luminosity, nor does it provide for the detection of malingerers. On shipboard it has a local applicability for elimination of those visually unfit for duty as night lookouts. Benjamin Milder.

Stern, H. J. A simple method for the early diagnosis of abnormalities of the pupillary reaction. Brit. Jour. Ophth., 1944, v. 28, June, pp. 275-276.

In the normal eye, if a pin point of light is projected on to the eye with the slitlamp in such a way that the light enters the pupil near the margin of the iris, the pupil contracts. Since no light then reaches the retina, the pupil dilates. Further, when the light reaches the retina, the pupil contracts. The artificial hippus thus begun continues regularly in the normal eye as long as light enters the pupil.

In cases of latent syphilis and early tabes with clinically normal pupillary reaction, the artificial hippus could not be produced. Usually a good contraction followed the first stimulus. This was succeeded by a few irregular, sluggish contractions, after which the pupil became immobile. This fact may become a useful diagnostic aid if subsequent investigations bear out the observations thus made on ten or twelve cases. Edna M. Reynolds.

2

THERAPEUTICS AND OPERATIONS

Dimitry, T. J. The therapeutic use of choline in ophthalmology. *Amer. Jour. Ophth.*, 1944, v. 27, Sept., pp. 1011-1014. (References.)

Heath, Parker. Chemotherapy in ophthalmology. *Jour. Amer. Med. Assoc.*, 1944, v. 124, Jan. 15, p. 152.

A general discussion of chemotherapeutic agents begins the article. The author stresses the importance of watching for toxic side actions with any effective drug. Specific suggestions for chemotherapy in some eye diseases are made, as follows: Oral sulfathiazole in usual dosage is given for inclusion blennorrhea, gonorrheal infections of the eye; oral sulfapyridine or sulfadiazine for keratitis and ulcer due to *B. pyocyaneus*, orbital abscess, thrombosis of the cavernous sinus, postoperative infections, late infections after trephining, enophthalmitis, and for certain cases of acute uveitis. Trachoma responds to sulfanilamide if secondary invaders are present. Hemolytic-staphylococcus conjunctivitis and blepharitis are treated by *Staphylococcus toxoid* and sulfathiazole ointment. Pneumococcic conjunctivitis is often helped by tyrothricin 0.3 percent drops in conjunction with oral administration of sulfapyridine or sulfadiazine. Tyrothricin irrigations may help dacryocystitis; and also, in connection with thermophore applications, dendritic ulcers.

Robert N. Shaffer.

Just Tiscornia, B., and Moret, R. L. Radium therapy in ophthalmology. *Arch. de Oft. de Buenos Aires*, 1942, v. 17, Sept., p. 543.

After discussing in detail the acci-

dents which the application of radium to the eyes may produce, the authors report 21 cases of tumors of the eye and its appendages treated with radium in the Municipal Institute of Radiology and Physiotherapy of Buenos Aires. From this experience the authors conclude that the tissues and media of the eye do not possess any special radiosensitivity. Early and late complications are mainly due to faulty technique or to treatments being too frequently repeated. If sight is to be preserved, neoplastic lesions of the ocular region, no matter how minimal, require a very rigidly regulated technique, applied in a single and effective treatment. (Illustrations, references.)

Plinio Montalván.

Swan, K. C., and White, N. G. Choline esters with mydriatic and cycloplegic action. *Amer. Jour. Ophth.*, 1944, v. 27, Sept., pp. 933-940. (5 figures, 4 tables, references.)

3

PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Crozier, W. J., and Wolf, E. Theory and measurement of visual mechanisms. 12. On visual duplexity. *Jour. Gen. Physiology*, 1944, v. 27, July 20, p. 513.

Since the advent, in 1866, of the theory of visual duplexity, postulating that the rods are responsible for scotopic vision and the cones for photopic vision, there has been general agreement on the existence of the two morphologic types, which are separable functionally (as evidenced by the duplex performance contours for flicker frequency obtained on visually duplex animals). It is not implied, however, that each phase of such a duplex curve of visual function is necessarily related

to one histologic type of reception; in fact such duplex curves are obtained in some species which possess only one type of photoreceptor cell.

In visually duplex vertebrates, the two groups of neural effects represented by the duplex flicker contours are independently variable (by changing wave length of the stimulus, the area of retina stimulated, and so on); but they do have a common dependence on the quantitative nature of the changes in flicker recognition by the organism. The implication is that the rod and cone groups of neural effects are closely related in a particular manner at the same general central focus.

The authors believe there is no direct correlation between flicker contour and retinal histology. They have examined the flicker response contours of several types to determine (1) whether or not visual duplexity is correlated with retinal duplexity, and (2) whether quantitative performance properties can be correlated with rod and cone categories of visual excitability. Flicker response contours were plotted for *Anolis* (a "chameleon" having a cone retina), and *Trionyx* (a turtle having a duplex retina, mostly cones). The first question was answered affirmatively by finding a simplex curve for *Anolis* and a duplex curve for *Trionyx*. In answer to the second question, it was found that no correlations were possible with zoological position on retinal structure; the quantitative characteristics of the performance contours could not be held to be characteristic of properties intrinsic to rods and cones. Thus, in visual duplexity, two groups of neural effects are available, but the curves do not describe properties of the specific photoreceptor units. Benjamin Milder.

Cushman, Beulah. Aniseikonia. Med.

Woman's Jour., 1944, v. 51, June, p. 17.

The examination for aniseikonia is indicated only in patients with binocular vision, after examination for refractive or muscular defects has been made, and after correction with glasses has failed to bring comfort. Symptoms may be photophobia, headaches, or inability to read for any length of time. Some patients with ocular discomfort and no refractive error may have aniseikonia which can be relieved by glasses that equalize the size difference of the retinal images. Some patients with quite typical ocular migraine have been so relieved. Many referred patients have been found to have a definite size difference in ocular images; 20 percent have been made perfectly comfortable with isekonic lenses; 60 percent have obtained partial relief and 20 percent no relief. The history is given of a patient aged 17 years, affected by discomfort for continued near work although a defect of refraction and a vertical-muscle imbalance had been corrected. Examination for aniseikonia and inclusion of the corresponding correction in his lenses resulted in complete satisfaction.

Melchiore Lombardo.

Evans, J. N. Medical aspects of refractive problems. *Sight-Saving Review*, 1943, Fall-Winter, v. 13, p. 147.

The time when the "eye man" fitted into the medical picture only through his ability to diagnose kidney disease and blurred discs in addition to his usual fitting of glasses has passed. Although the effect of specialization is narrowing no specialty has a right to exist unless it keeps its field intimately related to medicine as a whole.

To illustrate, the author takes the case of a patient who finds he is able to read without the help of his previous

"far-sighted" glasses. To be ruled out are glaucoma, early cataract, diabetes, inflammatory conditions in the eye, media changes due to medication concurrent or previous, and so on. In examination for "spots before the eyes" one must consider inflammations and hemorrhages, which bring up the whole field of the blood dyscrasias, hypertension, and arteriosclerosis. "Tired eyes" lead one to the anemias or possible cerebral lesions. "Double vision" suggests elaborate study as to neurologic disorders, from cerebral vascular accidents and tumors to multiple sclerosis. Owen C. Dickson.

Gillett, M. M. Seeing defects in non-readers. *Amer. Jour. Ophth.*, 1944, v. 27, Sept., pp. 1007-1010.

Guibor, George. Phenomena associated with eccentric fixation. *Amer. Jour. Ophth.*, 1944, v. 27, Sept., pp. 986-991. (13 photographs.)

Lebensohn, J. E., and Sullivan, R. R. Temporary stimulation of emmetropic visual acuity. *U. S. Naval Med. Bull.*, 1944, v. 43, July, p. 90.

The authors observe that all the methods cited as being of value in improving visual acuity have one factor in common, namely visuopsychic excitation. Sympathomimetic drugs and cortical stimulants should, therefore, also stimulate subjective visual responses.

Benzedrine and desoxyephedrine have been shown to produce an increase in the fusion frequency of flicker, a fundamental measurement of visual function. Alcohol may produce a decrease in visual acuity. Analeptics, such as coramine, function by virtue of their stimulation of the higher centers. The authors studied benze-

drine and coramine as to their efficacy in improving visual acuity and speed of vision. The former was measured on the Ferree-Rand chart of double broken circles; the latter was tested on the Lebensohn unlearnable letter chart, using a stop watch. The results indicated consistent improvement in acuity and reading speed, the improvement lasting over six hours for each drug. The authors suggest that such an improvement in absolute acuity in emmetropes may be advantageous in periods of exceptional stress.

Benjamin Milder.

Linksz, A., and Triller, W. "Biastigmatism." Evaluation and criticism of the refractive technique advocated by Márquez. *Amer. Jour. Ophth.*, 1944, v. 27, Sept., pp. 992-1002. (2 tables, references.)

Sloan, L. L. A quantitative test for measuring degree of red-green color deficiency. *Amer. Jour. Ophth.*, 1944, v. 27, Sept., pp. 941-947. (5 tables.)

Swan, K. C., and White, N. G. Choline esters with mydriatic and cycloplegic action. *Amer. Jour. Ophth.*, 1944, v. 27, Sept., pp. 933-940. (5 figures, 4 tables, references.)

#### 4

#### OCULAR MOVEMENTS

Davis, W. T. Amblyopia ex anopsia. *Ophth. Ibero Amer.*, 1944, v. 5, no. 4, pp. 327-339 (in Portuguese); pp. 339-344 (in English).

The late author recognized two types of amblyopia ex anopsia, one resulting from interference with the vision of one eye during the period of visual development, the other due to organic changes affecting central vision. Emphasizing



the mental effect of neglected strabismus upon the child, he discusses the usual routine of refractive correction followed by surgery or orthoptics or both according to necessity. He calls "dissociated hyperphoria" that which is the result of a lateral strabismus and not its cause; this type of hyperphoria should never be subjected to operation on the vertical muscle. (References.)

W. H. Crisp.

Ellett, E. C., Rychener, R. O. and Robinson, J. S. Appraisal of value of an orthoptic clinic in private practice. *Arch. of Ophth.*, 1944, v. 31, June, pp. 503-508; also *Trans. Amer. Acad. Ophth. and Otolaryng.*, 1944, May-June, p. 299.

An orthoptic clinic, available to all ophthalmologists in the city, has been operating in Memphis, Tennessee, for the past ten years. The clinic is conducted by two trained technicians and, if space and talent were available, the number of attendants could well be increased. The instruments used are briefly described. Treatment of anomalous retinal correspondence, of divergence excess, of divergence insufficiency, and of true and latent convergence insufficiency is discussed. The authors state that the Memphis Orthoptic Clinic has been a valuable adjunct in the handling of their private patients. (2 illustrations, references.)

John C. Long.

Magnus, John A. Congenital paralysis of both external recti treated by transplantation of eye muscles. *Brit. Jour. Ophth.*, 1944, v. 28, May, pp. 241-245.

A case of bilateral abducens paralysis in a child aged 12 years is reported. A transplantation of the outer halves of the superior and inferior rectus

muscles to the insertion of the paralyzed external rectus was done in the left eye and at the same time the external rectus was advanced and recession of the left internal rectus was done.

Transplantation was later performed on the right eye, combined with myectomy of the right inferior oblique. Because the left eye showed a slight hyperphoria, myectomy of the left inferior oblique and partial tenotomy of the left superior rectus were done later. The end result was satisfactory from a cosmetic point of view but no abduction was possible. Because of suppression of the image of the right eye, the patient had no double vision. (18 photographs, 2 drawings.)

Edna M. Reynolds.

Rosenbaum, H. D. Strabismus in the Army. *Military Surg.*, 1944, v. 95, July, pp. 48-52.

A recession operation for convergent strabismus was performed on 21 soldiers, of whom 20 required recession and resection with advancement of the weaker opponent. On the basis of the results obtained five of the men were reclassified to general service and two have gone to officer's candidate school. (References, 4 figures.)

M. Lombardo.

Wald, G., and Burian, H. M. The dissociation of form vision and light perception in strabismic amblyopia. *Amer. Jour. Ophth.*, 1944, v. 27, Sept., pp. 950-963. (3 figures, 1 table, references.)

White, J. W. Clinical application of the screen (cover) test described in detail. *Amer. Jour. Ophth.*, 1944, v. 27, Sept., pp. 977-986.

## 5

## CONJUNCTIVA

Aparisi, Tomás. Contributions to the treatment of vernal conjunctivitis. Arch. de la Soc. Oft. Hisp.-Amer., 1943, v. 3, Aug-Sept., pp. 190-193.

Basing the treatment of vernal conjunctivitis on the morphologic analogy between this condition and trachoma, the author used sulfanilamide in the same doses as used for trachoma. Marked improvement in symptoms is claimed, but recurrences were not prevented. (References.)

J. Wesley McKinney.

Aprigliano, Orlando. Bisulphate of quinine in local treatment of trachoma. Arquivos Brasileiros de Oft., 1944, v. 7, April, pp. 45-60.

The author describes in detail the routine treatment of trachoma with this drug in the Trachoma Dispensary of the Health Center of Jaú, State of São Paulo, Brazil. The treatment was introduced in 1935 by Elias Selinger of Chicago. Special nurses are trained to carry on mass treatment of large numbers of patients. The drug is used in solutions of 5 or 7.5 percent, and is massaged into the palpebral conjunctiva and the caruncle with saturated cotton swabs. Most of the Portuguese patients tolerate the treatment without a local anesthetic. As with other drugs used for trachoma, care must be taken to spare the cornea. The author summarizes the clinical course of thirty cases. (Bibliography.) W. H. Crisp.

Bauer, C. E., Gall, A. E. and Cox, C. D. Meningococcus conjunctivitis. Military Surg., 1944, v. 95, July, pp. 24-27.

The right eye of an infantry private of 38 years had been painful for three

days, with pain increasing in severity during the previous 24 hours. The eyelids were swollen and the conjunctiva moderately chemotic and congested, showing a membrane-like purulent exudate in the lower cul-de-sac. The corneal epithelium was edematous, with punctate areas of greyish infiltration. V.O.D. was 20/200, O.S. 20/30. A smear from the right eye showed Gram-negative intracellular diplococci, Neisserian in configuration. Cultures gave a growth which showed agglutination in polyvalent antimeningococcus serum. Warm irrigations, instillations of argyrol, sulfathiazol orally, and 25 millions of killed typhoid bacilli intravenously, stopped the growth of the organisms after 24 hours and the formation of exudate in 72 hours. Two other cases are reported with very similar history and bacterial findings. Some cases of conjunctivitis have been improperly termed gonorrheal on the basis of tinctorial and morphologic characteristics. The writers believe that meningococcic conjunctivitis is more common than heretofore considered.

M. Lombardo.

Blumberg, M. L., and Gleich, M. The simplified treatment of gonococcic ophthalmia neonatorum with chemotherapy. Jour. Amer. Med. Assoc., 1943, v. 123, Sept. 18, p. 132.

A comparative study of three groups of cases of gonococcic ophthalmia neonatorum is given to show simplification and efficiency of the new therapy of the disease. The first group of 14 cases was treated by frequent irrigation with boric-acid solution and 10 to 25 percent mild protein silver. The unaffected eye was protected with some such device as a Buller shield. The duration of the illness ranged from 6 to 46 days. In 35 percent of the

cases complications developed such as arthritis, metastatic abscess, involvement of the second eye, and corneal ulcer. The second group of 14 cases was treated with various sulfonamides orally, in doses of 1 to 1.5 grains per pound of body weight. All were treated with frequent irrigations of boric-acid solution and some with 10 to 20 percent mild protein silver. Only one baby developed a complication, namely involvement of the second eye on the second day of treatment, but both eyes cleared uneventfully. The duration of the disease ranged from one to seven days. The third group of ten cases was treated uniformly, regardless of the infant's weight and severity of symptoms, with 3 grains of sulfathiazole followed by 1 grain every four hours until the symptoms disappeared and smears from the conjunctiva were negative. The eyes were not irrigated and the unaffected eye was not protected. The duration of the disease was one to four days and no complications were observed. No recurrences were noted. The authors feel that mechanical protection and local therapy are unnecessary. Robert N. Shaffer.

Braley, A. E., and Sanders, M. Treatment of epidemic kerato-conjunctivitis. *Jour. Amer. Med. Assoc.*, 1943, v. 121, March 27, p. 999.

The authors suggest the use of convalescent serum as a possible means of treating epidemic keratoconjunctivitis. Because no other local or general therapy has been effective, the authors are giving this preliminary report based on results in ten cases. All cases had typical lid edema and bulbar chemosis with preauricular lymph node involvement. There was severe ocular discomfort. Conjunctival scrapings showed only mononuclear cells, and

cultures were negative. Corneal involvement to greater or less extent was present in six out of the ten cases. Treatment consisted of intravenous injection of 15 to 50 c.c. of convalescent serum with a titer of 10,000, though in two cases a titer of only 1,000 was used. Improvement began shortly afterward. Seven patients were clinically cured; the normal course of the disease was shortened in two; one case is classed as a failure.

Robert N. Shaffer.

Calkins, H. E., and Bond, G. C. Adaptation of virus of epidemic keratoconjunctivitis to development in extra-embryonic fluids of chick embryo. *Proc. Soc. Exper. Biol. and Med.*, 1944, v. 56, May, p. 46.

A strain of epidemic-keratoconjunctivitis virus was isolated by tissue culture and was given two mousebrain passages. A 10-percent suspension of a whole macerated brain was inoculated into the chorio-allantoic fluid of eight-day chick embryos. The embryos died in five to six days. The chorio-allantoic amniotic fluids were collected and pooled and twice again inoculated in chorio-allantoic fluid, then were passed through three mouse-brains and maintained in twelve consecutive embryo-fluid passages. This procedure increased the virulence, so that the present material is lethal for chick embryos in 0.001 c.c. doses, killing them in three to four days.

Human convalescent and hyper-immune rabbit serum will neutralize the embryo-fluid passage strain. The ease of handling this virus in extra-embryonic fluids and the success of neutralization tests suggest that this method might be of value in serologic diagnostic work. R. Grunfeld.

Fritz, W. H. Epidemic keratoconjunctivitis. *Med. Bull. Veterans Admin.*, 1944, v. 21, July, p. 48.

The author states that epidemic keratoconjunctivitis is not new, having been described in Austria in 1899. The symptoms, signs, and course of the disease are reviewed briefly, stressing glassy edema of the conjunctiva, predominantly unilateral occurrence, and frequent regional lymphadenopathy. The corneal lesions occur about eight days after onset of the conjunctivitis, and usually do not stain; they persist three to four months. The incubation period is five to twelve days, the cause probably virus. The disorder must be differentiated from acute catarrhal conjunctivitis and Beal's follicular conjunctivitis, neither of which shows corneal involvement. Symptomatic treatment has included atropine, quinine ointment, irradiation, and sulfa drugs. Recently cures have been reported with intravenous convalescent serum. Benjamin Milder.

Toledo, S. de A. Treatment of trachoma with sulfanilamide. *Arquivos Brasileiros de Oft.*, 1944, v. 7, April, pp. 68-74.

This article contains the instructions given to eye physicians in the Trachoma Section of the Department of Health of the State of São Paulo, Brazil.

Valentine, F. C. O., and Edwards, A. M. Angular conjunctivitis treated with propamidine. *The Lancet*, 1944, v. 247, June 10, p. 753.

The authors report the successful treatment of ten patients with angular conjunctivitis by the use of propamidine isethionate (4:4'-diamidinodiphenoxypropane di-(Beta-hydroxyethanesulfonate)).

One drop of 0.15 percent solution was instilled, after irrigating the eyes three times a day with boric-acid solution. Cultures were negative for Morax-Axenfeld bacillus in two to six days. There were no ill effects from the treatment, but in no case was it used for longer than 14 days. It is felt that the drug may prove useful in the treatment of other types of bacterial conjunctivitis. Benjamin Milder.

## 6

## CORNEA AND SCLERA

Castroviejo, Ramón. Keratectomies for treatment of corneal opacities. *Arch. of Ophth.*, 1944, v. 32, July, pp. 11-21.

After a résumé of the literature, the author presents in considerable detail, by description and by serial photographs, his technique in various types of corneal opacities. He discusses partial superficial keratectomy for treatment of band keratitis, dystrophia adiposa, and leukoma. Castroviejo also gives his technique of total superficial keratectomy for vascularized leukoma and its combination with corneal conjunctivoplasty for symblepharon. There is also a discussion of graft of buccal mucous membrane for vascularized leukoma, symblepharon, and recurrent pterygium. Penicillin ointment has been found to shorten the period of healing and to reduce the occurrence of infection. (References and 6 serial photographs.)

R. W. Danielson.

Fritz, W. H. Epidemic keratoconjunctivitis. *Med. Bull. Vet. Admin.*, 1944, v. 21, July, p. 48. (See Section 5, Conjunctiva.)

McCreary, J. F., Nicholls, J. V. V., and Tisdall, F. F. Further studies on

the relationship of corneal vascularization to riboflavin deficiency. Canadian Med. Assoc. Jour., 1944, v. 51, Aug., p. 106.

The authors have previously reported on the effects of riboflavin on corneal vascularization and symptoms of asthenopia; patients on a riboflavin deficient diet being selected. A marked improvement in both features was noted in those subjects who were given supplementary riboflavin for two months. The corneal vascular changes were recorded by means of a special ophthalmic camera.

In the present study, a contrasting group of patients was selected, in that this group had been on an adequate riboflavin intake (2.9 mg. daily) for a year prior to the investigation. The present study was furthermore carried out by slitlamp examination as well as photographic record. The photographs show the blood-filled limbal vessels well, but the slitlamp was found to be better for the collapsed vessels.

One group of patients was given supplemental riboflavin (9.9 mg. daily) for two months; another group received a placebo. Slitlamp and photographic studies were made without regard to previous data on the subject. The authors found no significant difference in the extent of limbal vascularization in the two groups; and the slitlamp and photographic findings were closely parallel. It is concluded that uniform peripheral corneal vascularization is not a safe basis for a diagnosis of current riboflavin deficiency, although it may indicate a pre-existing deficiency.

Benjamin Milder.

Vázquez Barrière, A. The cornea in acquired syphilis. Arch. de Oft. de Buenos Aires, 1942, v. 17, Nov., p. 663. Interstitial keratitis in acquired

syphilis usually shows an atypical form; it is generally unilateral and the corneal infiltration is usually partial. In this group is included the syphilitic keratitis punctata of Mauthner, of which the author reports a case with involvement of one eye and later of the other. The initial lesion, a phagedenic chancre, had not yet healed at the time the eyes became involved. Antiluetic treatment cleared up the condition in a short time, with good visual results. The author reports two cases of keratitis pustuliformis profunda of Fuchs. In one case the condition was bilateral and one eye showed a perforation of the cornea with formation of an adherent leucoma; while the lesions in the fellow eye underwent almost complete resolution with antiluetic treatment, useful vision being preserved. In the second case the disease was unilateral, but a secondary glaucoma developed, which required several paracenteses before arsenic-mercury treatment cleared up the lesions. The rapid response of keratitis pustuliformis to antiluetic treatment is stressed. Gummata of the cornea are extremely rare and very difficult to differentiate from keratitis pustuliformis profunda. The author believes that while the subject has not been exhaustively studied, syphilis may produce superficial ulcerative keratitis, in proof of which he mentions the many instances of atonic corneal ulcer which heal only after antiluetic treatment is resorted to. Likewise due to syphilis is a peculiar type of nodular or phlyctenular keratitis of which the author reports a case.

Plinio Montalván.

7

UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Damel, C. S., and Durando, S. A. Traumatic cysts of the iris and eye-

lashes in the anterior chamber. Arch. de Oft. de Buenos Aires, 1942, v. 17, Oct., p. 614. (See Section 16, Injuries.)

Hague, E. B. Uveitis, dysacusia, alopecia, poliosis, and vitiligo. Arch. of Ophth., 1944, v. 31, June, pp. 520-538.

Because of its completeness and complexity, this monograph is difficult to abstract. A detailed general description is followed by special discussion of each of the various signs in the syndrome.

Hague says the ensemble of symptoms is too consistent to suggest a heterogenous pathogenesis. It is significant that all, or practically all, of the manifestations of the syndrome have followed (a) an infection of the upper respiratory tract combined with suggestion of encephalitis, (b) severe emotional trauma, or (c) a tumor pressing on the hypothalamus. Embryologically, the retina is closely connected with the hypothalamus and the third ventricle.

The author reports a typical case in detail and says that he has tried to account for the bizarre and striking manifestations in terms of a discrete lesion. Some of the bases for the belief are: (1) clinical evidence of oculocutaneous pigmentosis, pointing to early involvement of the hypothalamus; (2) the close relation of the posterior segment of the eyeball, structurally, embryologically, and phylogenetically, to the hypothalamus, and of the latter to centers and tracts controlling or affecting hearing and pigmentation of the eyes, hair, and skin; and (3) functional considerations pointing to retinohypothalamic relations.

Hypothalamic involvement would account for the lethargy and cryesthesia which some of these patients experience. Only one lesion, and that in the suprachiasmatic region, can account

for all the symptoms of this syndrome.

The frequency with which cases of this syndrome are immediately preceded by an influenza-like episode of encephalitis has been noted. That influenza and certain forms of encephalitis are due to virus infection is now common knowledge. Workers in the field of virus disease contend that certain neurotropic viruses may pass along the nerve pathways connected with the hypothalamus and that they tend to localize in the latter region and there to produce local necrosis. (Bibliography, 3 photographs, 1 figure.)

R. W. Danielson.

Kamellin, Samuel. Uveitis associated with Hodgkin's disease. Arch. of Ophth., 1944, v. 31, June, pp. 517-519.

Kamellin gives the differential diagnosis of Hodgkin's disease from glandular tuberculosis, lymphosarcoma, and Boeck's sarcoid. He then presents the case of a 26-year-old man who had both Hodgkin's disease and bilateral uveitis. Whether the uveitis in this case was due to the Hodgkin's disease or was a concomitant disease was not clear. Since, however, the tests and examinations did not reveal any positive indication of other disease and there was pathologic and roentgenographic evidence of Hodgkin's disease, Kamellin is inclined to believe that the ocular condition was due to the Hodgkin's disease. (3 figures, one in color, one reference.) R. W. Danielson.

## 8

### GLAUCOMA AND OCULAR TENSION

Chandler, P. A. Treatment of glaucoma. Arch. of Ophth., 1944, v. 32, July, pp. 23-32.

This paper is so substantial that an abstract is inadequate; a few highlights only can be given.

In acute glaucoma, the author uses the Cogan method of instilling glycérine to clear the edematous cornea in order to permit study of the back of the cornea, the aqueous, and the iris with the slitlamp; and also, if the lens is reasonably clear, the fundus. This enables him to make a differentiation between primary and secondary glaucoma. He always attempts to lower the tension with a miotic before operating. Five percent neostigmine bromide combined with 20 percent mecholyl chloride is probably the most effective miotic. One may use 4 percent pilocarpine nitrate or 1 percent physostigmine salicylate.

The rules for surgery in acute glaucoma are as follows: (1) If the attack is less than 48 hours old, iridectomy is chosen whether or not the tension drops to normal under preoperative miotics. (2) If the attack is 48 hours old or more, iridectomy is done if the tension comes fully to normal preoperatively and can be maintained there with reasonable use of miotics. (3) If the attack is 48 hours old or more and the tension cannot be brought to normal with miotics, a filtering operation is chosen. In these conditions it has been the author's experience that iridectomy only succeeds in changing the condition from acute to chronic glaucoma. Trephining has not been successful. The operation most successful in his hands for this type is sclerectomy combined with iridencleisis.

As for surgery, the author stresses the well-known fact that, as a rule, eyes with early glaucoma do much better after surgical intervention than those in which the disease is advanced. Chandler favors trephining for younger and iridencleisis for older patients. When an iris-inclusion operation is

performed on a younger patient, sclerectomy is done. Gentleness in handling the iris is stressed.

In chronic glaucoma coexisting with immature cataract, miotics should be used as long as possible before resorting to surgery. If the vision is cut down to 20/50 or less by the opacities in the lens, intracapsular extraction with a broad basal iridectomy will often control the glaucoma. If central vision is 20/40 or better without miotics and miotics reduce the vision below 20/40, broad iridectomy followed by miotic therapy is preferred to immediate extraction of the cataract.

For treatment of buphthalmos or infantile glaucoma, iridencleisis has proved more successful than trephining. In any operation for glaucoma of this type it is regarded as of the greatest importance that adequate massage be carried out by the parents after the child leaves the hospital. In treatment of glaucoma due to iris bombé, Chandler favors iridectomy rather than transfixion of the iris. Glaucoma following discission of the intact lens or following traumatic cataract calls for prompt linear extraction of the lens. In hypermature cataract, combined intracapsular extraction at one operation is favored, rather than preliminary iridectomy. (Fields.)

R. W. Danielson.

Fortín, E. P. Considerations concerning glaucomatous diseases. *Arch. de Oft. de Buenos Aires*, 1942, v. 17, Oct., p. 641.

The author presents several histologic sections of eyes on the basis of which various aspects of glaucoma are discussed. The article does not lend itself to abstracting. (Photomicrographs.) Plinio Montalván.



Igersheimer, Joseph. Intraocular pressure and its relation to retinal extravasation. *Arch. of Ophth.*, 1944, v. 32, July, pp. 50-55. (See Section 10, Retina and vitreous.)

Uribe Troncoso, Manuel. Development of anterior peripheral synechiae in experimental acute glaucoma. *Arch. of Ophth.*, 1944, v. 31, June, pp. 481-502.

Acute glaucoma was produced experimentally in rabbits, dogs, and monkeys by injections of serum, of defibrinated blood, and of whole blood into the anterior chamber. It was shown that the first step in the production of glaucoma by these agents was not mechanical obstruction of the channels of outflow by the base of the ciliary body and the root of the iris, but a disturbance in the normal outflow of aqueous. This was accompanied by a tissue response of vasodilatation and edema in the base of the ciliary body, which obliterated the ciliocleral sinus, with resulting adhesions and swelling of the processes. The root of the iris was pushed forward by the thickened processes, making the anterior chamber shallow and producing anterior peripheral synechiae.

Injection of serum into the aqueous, because of the colloidal state thus induced, caused inversion of the normal current, the colloidal aqueous sucking fluid from the intrascleral vessels. The filling of the sinus with serum or blood, and later with fibrin, prevented the normal aqueous in the chamber from reaching the trabecular vessels on the surface of the sclera. This obstruction hindered the outflow of fluid and immediately promoted a great increase in intraocular pressure. The neurovascular response to the experimental glaucoma was different with the dif-

ferent agents employed. Serum alone produced an especially conspicuous response in the iris, while with defibrinated blood the response was greater in the processes and base of the ciliary body. Pure blood coagulated in the anterior chamber and the sinus, occluding the latter and coating the walls of the anterior chamber.

The article contains an anatomical description of the chamber angle in the animals used, details of the technique of injection, detailed reports of the experimental findings, and photomicrographs of the sectioned experimental eyes. (29 figures, bibliography.)

John C. Long.

## 9

### CRYSTALLINE LENS

Meroni, J. C. A. A case of bilateral cataract following electric shock. *Arch. de Oft. de Buenos Aires*, 1942, v. 17, Oct., p. 633. (See Section 16, Injuries.)

Pahwa, M. D. Intracapsular extraction of senile cataract. *Arch. of Ophth.*, 1944, v. 32, July, pp. 48-49.

The author has performed 170,000 cataract operations, most of them intracapsular. This paper describes his technique. Anesthesia is by instillation of 2-percent butacaine sulphate, with no retrobulbar or subconjunctival injection and no akinesia. A full 180-degree section is used, the knife coming out 1 mm. below the upper border of the cornea. Iridectomy is performed in all cases. At this stage the speculum is removed, and the assistant lifts the upper eyelid with a strabismus hook held in his right hand and pulls the lower lid down with the fingers of his left hand. The surgeon places his left thumb just above the eyebrow and slightly pulls it up, and in the other

hand he holds the other strabismus hook. This hook is now applied to the sclera 2 mm. below the junction, at about the 6-o'clock position. It is slowly drawn up toward the limbus with very slight backward pressure, which movement dislocates the lens. The lens is then delivered by "tumbling."

R. W. Danielson.

## 10

### RETINA AND VITREOUS

Givner, I., and Roizin, L. Juvenile amaurotic familial idiocy. *Arch. of Ophth.*, 1944, v. 32, July, pp. 39-47.

Cerebromacular degeneration, or the juvenile form of amaurotic familial idiocy, was first described by Batten in 1903. The clinical features of this disease were progressive loss of the intellectual faculties, loss of vision, and loss of motor power. Two cases are reported and the histopathologic literature is covered in considerable detail.

From an etiopathogenic point of view, Sachs's concept that the disease is a disturbance of the nervous system of primary and degenerative character still stands true even if viewed in the light furnished by recent investigations. Schaffer's hypothesis that it is a heredodegenerative disease restricted only to neuroectodermal derivatives and transmitted through the hyaloplasm does not seem to Givner and Roizin to be supported by their observations. These authors conclude that the histochemical reactions evidenced by their investigation point to the presence, in involved cells of both retina and brain, of the same type of lipids, that is, a mixture of phosphatides and cerebroside. (References, 10 photomicrographs.)

R. W. Danielson.

Igersheimer, Joseph. Intraocular

pressure and its relation to retinal extravasation. *Arch. of Ophth.*, 1944, v. 32, July, pp. 50-55.

The author's interest in this subject was initiated by the study of a middle-aged person with glomerulonephritis who had the combination of high blood pressure, an unusually large amount of nonprotein nitrogen in the blood, primary glaucoma, and absence of retinopathy. From the study of this case and others in the literature, Igersheimer concludes that it appears that high intraocular tension influences the extravasation into the retina and that retinopathy, such as albuminuric or diabetic retinitis, diminishes or disappears when glaucoma develops or does not occur in an already glaucomatous eye.

Another condition undoubtedly related to lowering of the intraocular pressure must be discussed. This is the papilledema which occurs sometimes in eyes with very low pressure (after penetrating wounds or in disease) and which disappears when the intraocular tension becomes normal. Parker has demonstrated that when both eyes have equal tension, papilledema develops to an equal degree in the two eyes. If the tension in one is lower than that in the other eye, papilledema generally develops first in the eye with the lower tension.

The author states that while the condition of the capillaries, the content of the blood, and the resistance to the outflow of blood and lymph from the globe are the main factors whose pathologic alteration may produce increased passage of fluids and corpuscles through the vessel walls of the retina, intraocular pressure also seems to play a certain rôle in these transudative phenomena. (References.)

R. W. Danielson.

Lepard, C. W. Lipemia retinalis in the nondiabetic patient. *Arch. of Ophth.*, 1944, v. 32, July, pp. 37-38; also *Trans. Amer. Ophth. Soc.*, 1943, v. 41, p. 536.

It has been supposed that lipemia retinalis is always associated with diabetes but such is not the case. The level of blood lipids at which lipemia retinalis is first recognized and the level at which it disappears have been carefully determined by several authors. It appears approximately when blood fats increase to above 3.5 percent and disappears when these fats decrease to below 2.5 percent.

In a six-year-old boy, lipemia retinalis was present during the entire time the patient was under observation. On a low fat diet it could be recognized only in the smaller divisions of the central artery and vein in the more peripheral portions of the fundus of each eye. With a high fat diet the arteries and veins throughout their entire extent were increased to twice their size and approached a common creamy color, so as to be indistinguishable from each other. Although lipemia retinalis is usually seen in the young person with severe diabetes, it is a phenomenon resulting from a rise in the level of the blood lipids and may occur in the presence of normal carbohydrate metabolism. Blood lipids containing a high percentage of neutral fat seem more likely to produce characteristic retinal changes than do those containing a low percentage of neutral fat. (References, 3 tables, 1 photograph.)

R. W. Danielson.

Lijó Pavía, J. Detachment, reattachment, tears, and cyst of the retina. *Arch. de Oft. de Buenos Aires*, 1942, v. 17, Nov., p. 708. (See *Amer. Jour. Ophth.*, 1943, v. 26, p. 644.)

## 11

## OPTIC NERVE AND TOXIC AMBLYOPIAS

Esposito, A. C. Neurosyphilis and the oculist. *Med. Bull. Veterans Admin.*, 1944, v. 21, July, pp. 51-54.

At the Veterans Administration Facility, Chillicothe, Ohio, all neurosyphilitic patients are seen by the oculist before treatment is instituted. A complete examination is recorded, the visual fields being by confrontation or perimeter, depending on the cooperation of the patient.

During a first series of tryparsamide injections, the visual fields, fundi, and central vision are examined after each injection; periodic re-examinations are further made during all subsequent courses of tryparsamide therapy. The author found that 26 of 204 patients on tryparsamide developed toxic involvement of the optic nerve; of this number, only 11 were detected during the first course of therapy. Most of these were found between the third and seventh injections of any course. The resulting atrophy is best treated by malarial fever, as well as continued trivalent arsenic and bismuth therapy. Vitamins and subdural therapy have not proved successful.

Benjamin Milder.

Glicklich, E. A., Schultz, A., and Benjamin, J. E. Tuberculous sclerosis associated with tumor of the optic disc (phacoma). *Arch. of Ophth.*, 1944, v. 32, July, pp. 60-62.

The authors present a detailed report of a case of tuberculous sclerosis in a 22-year-old soldier with the characteristic syndrome of adenoma sebaceum, epilepsy, and mental deficiency, associated with tumor of the optic disc. Though phacomias occur less frequent-

ly in tuberous sclerosis than the cutaneous lesions or the mental disturbances, changes in the fundus may sometimes be the sole manifestation of this syndrome. Under such circumstances tuberous sclerosis must be differentiated from the allied conditions in which retinal phacomias occur, namely, von Recklinghausen's neurofibromatosis, Hippel's retinal and Lindau's cerebral angiomatosis, the Sturge-Weber syndrome (angiomatosis cerebri), and retinal glioma.

The origin of tumors of this type is still not certain, though they are generally recognized as primarily ectodermal malformations, consisting of glial tissue and undifferentiated elements, including mesoderm, initiated by developmental and hereditary factors. (References, 2 illustrations.)

R. W. Danielson.

Prado, D. L. Arsenical compounds and toxicity for the optic nerve. Contraindications. *Arquivos Brasileiros de Oft.*, 1944, v. 7, April, pp. 61-68.

The author reviews the various arsenicals in use in Brazil. Trivalent arsenicals (sulfarsenol is an example) have little toxicity for the optic nerve, but should never be used when there are lesions of the ocular fundus. Two illustrative cases are briefly reported, one with fundus photograph. The pentavalents have a more accentuated neurotropism than the trivalents. In the clinic at Santos, State of São Paulo, Brazil, two cases of optic-nerve atrophy in patients subjected to treatment with acetylarsan have been observed. Among 380 patients subjected to stovarsol, only 18 cases of ocular disturbance have been seen, none of which went on to blindness. The author discusses the different theories as to the pathogenesis of disturbances

of the optic nerve under arsenical treatment for syphilis. W. H. Crisp.

Rucker, C. W. Defects in visual fields produced by hyaline bodies in the optic discs. *Arch. of Ophth.*, 1944, v. 32, July, pp. 56-59.

The presence of hyaline bodies in the optic disc occasionally produces an appearance that may simulate chronic papilledema with secondary optic atrophy. When the glistening bodies are large and lie near the surface, they cause little difficulty in diagnosis; but when they are small and lie buried so deeply within the nerve substance as to be scarcely visible they may cause a fulness that is difficult to explain. Unless looked for specifically they may pass unnoticed. Not only is the appearance of the optic discs misleading, but field defects are encountered rather frequently in this condition, either in the form of peculiar contractions or of arcuate scotomas. Such defects may confuse the diagnostician still further. In this article, the author gives five typical case histories along with the field defects and fundus pictures. (One reference, 5 figures.)

R. W. Danielson.

Schlezinger, N. S., Waldman, J. and Alpers, B. J. Drusen of the optic nerve simulating cerebral tumor. *Arch. of Ophth.*, 1944, v. 31, June, pp. 509-516.

Two cases of drusen of the optic nerve were observed that presented symptoms very suggestive of cerebral tumor. The first patient was a woman of 23 years who had had right hemiparesis for years and had suffered from left-sided headaches for three years. The fundi showed bilaterally many lemon-yellow drusen on and near the upper and nasal margins of the optic

disc. The optic discs appeared elevated. The results of a neurologic examination were negative, and pneumoencephalograms were negative for cerebral tumor. The second patient was a man of 35 years who had suffered from frontal headaches for 1½ years and had had attacks of vomiting for two years. The fundi showed bilateral drusen of the nerves with 1.5 D. of papilledema. The visual fields were constricted and the blind spots were enlarged. In this case, also, neurologic and pneumoencephalogram examinations were negative for tumor.

Drusen are probably derived from the neuroglia cells in the optic nerve as a result of some irritative, metabolic, or degenerative process. It is likely that drusen start as minute globules of hyalin, which increase in size by accretion in layers or by fusion. Drusen which are situated anterior to the choroidal ring may present a striking appearance. As the result of their presence the disc may be considerably elevated and may show an increase in diameter. Drusen which are situated deep in the sclerochoroidal canal are probably not visualized with the ophthalmoscope. Such drusen may give abnormal fullness to the disc and enlargement of the blind spot. In many instances, so-called pseudoneuritis may really represent a deeply situated druse. Usually drusen of the optic nerve cause little if any visual impairment, but there are on record cases in which vision was severely affected. In the two cases here described, as well as in other reported cases, the association of severe headaches with drusen has been striking. No adequate explanation for the occurrence of these headaches can be given at present. (4 illustrations, bibliography.)

John C. Long.

## 13

## EYEBALL AND ORBIT

Blaess, M. J. Cosmetic ocular rehabilitation. U. S. Naval Med. Bull., 1944, v. 43, July, p. 96.

The author stresses the great importance of the use of an implant in Tenon's capsule, following an enucleation. It is essential that an implant be of proper size, that the capsule and muscles be replaced in anatomic position, and that the maximum amount of conjunctiva be preserved. The writer cites Wiener and Alvis, Allport, Weeks, Clapp, De Schweinitz, and Wheeler in support of the advantages of using an implant. Omission of the implant leads to retraction of the upper lid, tilting of the prosthesis, and sagging of the lower lid. Tantalum is suggested as an excellent metal for the implant.

Recent introduction of molded plastic prostheses has aided cosmetic rehabilitation. The author also mentions the use of contact lenses over quiet blind eyes.

Benjamin Milder.

Walsh, F. B., and Dandy, W. E. Pathogenesis of intermittent exophthalmos. Arch. of Ophth., 1944, v. 32, July, pp. 1-10.

Intermittent exophthalmos is a rare but striking and unmistakable syndrome. It is characterized by a pronounced and rapid protrusion of one eye when venous stasis is produced by various positions of the head and neck. The ocular protrusion disappears immediately when the head is erect or when artificially induced venous congestion is relieved. In fact, usually but not invariably, there is enophthalmos when venous congestion does not obtain. Vision may or may not be affected. The condition is progressive. There may be pulsation.

The authors report the case of an 18-year-old girl who had had a typical history for ten years. There was enophthalmos of 3 mm. when the head was erect. The exophthalmos was as follows: 6 mm. when lying recumbent; 11 mm. when the head was tilted forward or the jugular vein was compressed; 18 mm. when expiration was forced and the nostrils were compressed; 5 mm. when the head was turned forcibly to the left, and 3 mm. when it was turned to the right. The eyegrounds were normal.

From study of the case the following conclusions are drawn: (1) The quick protrusion and sinking of the eyeball with the postural changes, and the rapid protrusion induced by coughing, sneezing, and jugular compression could only mean filling of a large venous bed. (2) The pulsation of the eyeball indicates an arterial component. The lesion, therefore, had to be an arteriovenous aneurysm. (3) The absence of a murmur indicates that the communication between arteries and veins was through vascular "coils," and not through a fistula. (4) The enophthalmos (with the patient sitting or standing) is thought to have been due to atrophy of the orbital fat from long-continued pressure.

At operation, a frontotemporal approach to the cranial chamber was made—a typical hypophyseal approach. When the dura was turned back, a large venous mass was found. This was treated by cautery. After surgery the eyeball was free of all the intermittent changes that previously obtained, but the eye was blind, and all the extraocular muscles were paralyzed.

The authors give a complete summary of the condition as reported in the literature. (References, 5 figures, one in color.) R. W. Danielson.

## EYELIDS AND LACRIMAL APPARATUS

Klunzinger, W. R. Autoinoculation of the eyelids with vaccinia. *Arch. of Ophth.*, 1944, v. 31, June, pp. 539-540.

Accidental inoculation of the eyes with vaccinia may occur by transfer of the virus either from the site of vaccination of the patient or from one person to another. The lids, conjunctiva, or cornea may be involved. Corneal lesions have been observed in approximately one third of the reported cases, often with serious visual impairment. In cases resulting from autoinoculation, the sooner the secondary inoculation follows the primary, the more severe and the more prolonged is the secondary reaction.

An eight-year-old boy developed redness and swelling of the lids of both eyes three days after vaccination. The condition of the lids became progressively worse. At the same time a lesion developed on the chin and gradually progressed to a typical vaccinia reaction. The lids of both eyes showed pronounced redness, swelling, and induration, with several marginal ulcerations. There was a moderate mucopurulent discharge. Sulfadiazine, used for a short time, seemed to reduce the fever but had no apparent influence on the lesions, which finally healed without complication. (One photograph, references.) John C. Long.

Mouillie, H., and García Querol, A., Dacryostomy after resection of the lacrimal sac (Arruga's operation). *Arch. de Oft. de Buenos Aires*, 1942, v. 17, Nov., p. 693.

Dacryostomy following Arruga's technique was performed two years after the lacrimal sac had been removed. Drainage of the tears was suc-

successfully established. The several steps of the operation are described in detail.

Plinio Montalván.

## 15

### TUMORS

González Vanrell, Francisco. Adenopapilloma of the semilunar fold. Arch. de Oft. de Buenos Aires, 1942, v. 17, Nov., p. 675.

A case is reported in which a mulberry-like tumor, about 6 mm. in size, was observed in the semilunar fold of the right eye. The tumor was excised and histopathologic examination showed it to be an adenopapilloma. Its rarity is stressed. (References, illustrations, photomicrographs.)

Plinio Montalván.

## 16

### INJURIES

Ayberk, N. F. Sodoku in the eye. Göz Klinigi, 1944, v. 1, no. 4, pp. 139-144.

Report of a rare case of sodoku (rat-bite infection) in the eye. A sailor, lying in bed, one night felt a bite in the right upper lid. Ten days later swelling and reddening of the lid started. Then a "phlyctenule" developed, with secondary ulceration. The organs of a mouse infected with the blood of the patient showed typical spirilla. After three injections of neoarsphenamine, the general symptoms (malaise, fever) disappeared and the lid wound healed. (6 illustrations, references.)

Joseph Igersheimer.

Damel, C. S., and Durando, S. A. Traumatic cysts of the iris, and eyelashes in the anterior chamber. Arch. de Oft. de Buenos Aires, 1942, v. 17, Oct., p. 614.

The authors report three cases of

penetration of lashes into the anterior chamber through perforating wounds of the globe. In the first case the eye was enucleated on account of repeated and violent inflammatory attacks with vision reduced to light perception. In the other two cases implantation cysts of the iris developed and were successfully excised in toto with a small iridectomy at the base of the cyst. The authors believe this procedure to be the treatment of choice. Histopathologic sections were made in the three cases. The subject of cysts of the iris is discussed in detail, with particular emphasis on differential diagnosis. (Illustrations, photomicrographs, references.)

Plinio Montalván.

Gallino, J. A. Obstetrical trauma of the cornea. Arch. de Oft. de Buenos Aires, 1942, v. 17, Sept., p. 529.

A case is reported in which trauma to the corneas of a new-born was produced by the forceps blades. There was a diffuse opacity the first few days, which cleared up leaving white glassy lines on the cornea as permanent defect. The literature on the subject is reviewed and the pathogenic theories are discussed in detail. (Illustrations, references.)

Plinio Montalván.

Meroni, J. C. A. A case of bilateral cataract following electric shock. Arch. de Oft. de Buenos Aires, 1942, v. 17, Oct., p. 633.

A 26-year-old man sustained an electric shock produced by a 4400-volt current and two months later presented in the left eye an anterior subcapsular cataract which became mature in a short period of time. One year after the accident similar cataractous changes began to take place in the other eye. The eyes were otherwise essentially normal. Laboratory exam-



inations were negative. Combined extracapsular extraction of the mature cataract was carried out without incident and the final visual result was good. The bibliography on electric cataract is reviewed and the mechanism of production discussed in detail. (References.) Plinio Montalván.

Rosen, Emanuel. Chalcosis lentis associated with traumatic lenticonus posterior. *Arch. of Ophth.*, 1944, v. 32, July, pp. 63-65.

Chalcosis lentis has been encountered frequently during the present war because of the employment in armaments of numerous alloys, some containing copper. The toxicity of copper within the globe is well known, and the production of a characteristic "sunflower" just below the anterior capsule of the lens has been regarded as one of the pathognomonic signs of chalcosis lentis. A soldier had received a puncture wound with copper in civilian life, when a 22-mm. rifle backfired and exploded directly into his eye. Several authors are quoted as showing that the copper particles lie in the region of the epithelial cell layer, with deposition in the protoplasm, and with the nucleus of the cell remaining free of the copper. (References.) R. W. Danielson.

Sherman, E. S. Industrial injuries of the eye. *Arch. of Ophth.*, 1944, v. 32, July, pp. 33-36.

This paper covers the common-sense rules involved in industrial work. Accurate and complete records and reports are stressed in order to protect both the employee and the employer. (References.) R. W. Danielson.

its relation to general tuberculosis. *Arch. of Ophth.*, 1944, v. 31, June, pp. 541-556.

The first part of this review is devoted to a historical sketch of the development of knowledge of tuberculosis. The observations of Pott, Bichat, Laënnec, Scarpa, Helmholtz, Jaeger, Graefe, Villemin, Pasteur, Koch, and many others are quoted.

The second portion of the review is devoted to the diagnosis of ocular tuberculosis and its relationship to the generalized disease. A number of modern, and often contradictory, views are quoted. The reviewer states that, from the literature cited, the following facts are evident: Tuberculous ocular disease is not nearly so common as generally supposed. Phlyctenular keratoconjunctivitis is not usually of tuberculous origin. The fact that phlyctenular disease has decreased with better living standards, better diet, and the administration of vitamins leads one to think that it is of metabolic origin. Uveal tuberculosis is not necessarily secondary to tuberculosis elsewhere in the body. Bacilli may enter the blood stream and attack the eye directly without pulmonary involvement. The nature of an infection in the anterior segment should be determined in the laboratory. When it is impossible to obtain a specimen of uveal tissue, a presumptive diagnosis may be made by the microscopic appearance of the lesion, by the general status of the patient as to tuberculosis, and by exclusion of other causative factors. Tuberculin tests are of limited value. A negative test may be obtained in the presence of tuberculosis, and a positive test does not determine the location of the tuberculous process. (8 illustrations references.)

John C. Long.

## NEWS ITEMS

Edited by DR. DONALD J. LYLE  
904 Carew Tower, Cincinnati 2

News items should reach the editor by the twelfth of the month

### DEATHS

Dr. John D. Hogue, Altoona, Pennsylvania, died July 19, 1944, aged 62 years.

Dr. Edwin M. Neher, Laguna Beach, California, died July 8, 1944, aged 69 years.

### MISCELLANEOUS

The Office of the Surgeon General has designated the following hospitals as special-treatment centers: For plastic surgery and ophthalmologic surgery—Baker General Hospital at Martinsburg, West Virginia; Beaumont at El Paso, Texas; Cushing at Framingham, Massachusetts; Dibble at Menlo Park, California; Northington at Tuscaloosa, Alabama; O'Reilly at Springfield, Missouri; Valley Forge at Phoenixville, Pennsylvania; and Wakeman at Camp Atterbury, Indiana. For ophthalmologic surgery and the blind—Dibble General Hospital at Menlo Park, California, and Valley Forge at Phoenixville, Pennsylvania.

### SOCIETIES

At a recent meeting of the Board of Directors of the Academy of Medicine of Cleveland, Dr. A. B. Bruner, Professor of Ophthalmology, Western Reserve University School of Medicine, was elected President of the Academy.

At the ninety-fifth annual meeting of the Indiana State Medical Association held in conjunction with the Army Air Force medical services at the Murat Temple, Indianapolis, Major

John G. Bellows (MC) read a paper on "Penicillin in ophthalmology."

Dr. Frederick A. Davis, Madison, Wisconsin, was among the guest speakers at the Inter-State Postgraduate Medical Association of North America assembly at the Palmer House, Chicago, Illinois, October 17th to 20th. The title of his lecture was "What the general practitioner should know about ophthalmoscopic examinations."

The South Carolina Society of Ophthalmology and Otolaryngology held a refresher course from October 31st to November 2d. Among those conducting the course were Dr. Henry M. Goodyear, Cincinnati; Dr. James S. Shipman, Philadelphia; Dr. James W. White, New York; and Dr. Oscar V. Batson, Philadelphia.

At the fifty-fifth annual meeting of the American Pediatrics Society a paper on "Congenital malformations of eyes induced by maternal vitamin-A deficiency" was given by Dr. Josef Warkany and Elizabeth Schraffenberger, Cincinnati.

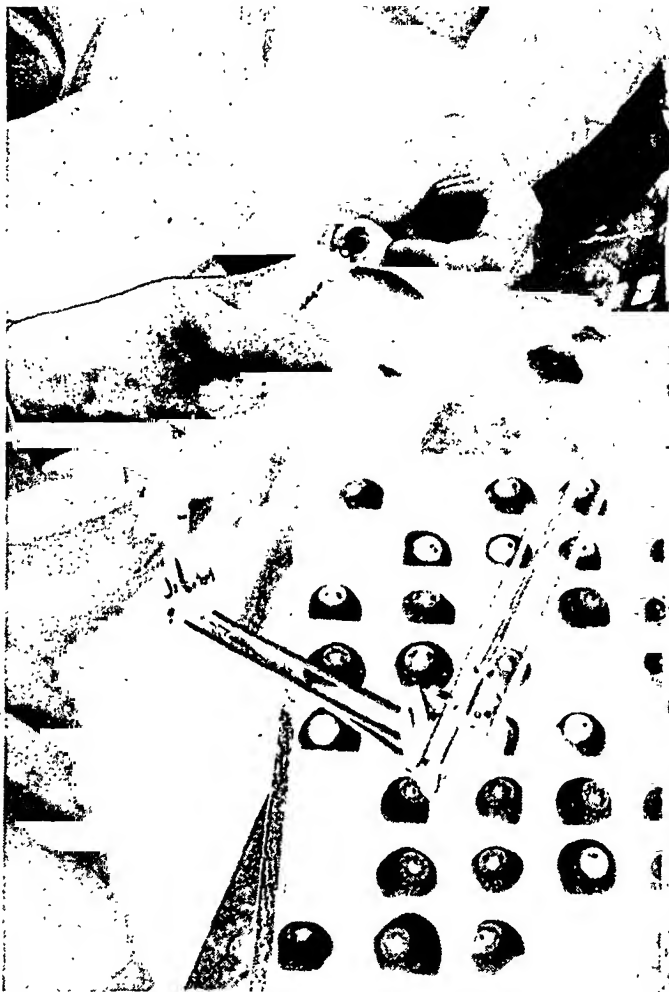
The Reading Eye, Ear, Nose, and Throat Society of Reading, Pennsylvania, elected the following officers for the fiscal year 1944-45: Dr. Michael J. Penta, president; Dr. R. M. Brickbauer, first vice-president; Dr. Isaac B. High, second vice-president and president-elect; Dr. Harold L. Strause, treasurer; Dr. Paul C. Craig, secretary.

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